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THE POSSIBILITY OF TRANSMITTING A CALENDRA INFESTATION FROM WHEAT TO MACARONI THRU THE PROCESSES OF MILLING AND MANUFACTURING[1]

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ABSTRACT

The question of whether or not a granary weevil infestation could pass directly from the wheat to the macaroni has been of great practical importance to the milling and macaroni industries. In the experiments described in this paper it was shown that (1) no stage of the weevil could survive the process of milling the durum wheat into Semolina from which the marcaroni is manufactured. Even the eggs were unable to survive this process, (2) that the adult weevils would not oviposit in the semolina, (3) even if the weevils or their eggs were present in semolina they could not survive the process of manufacturing the macaroni. It was also found that the weevils are introduced into the factory and lay their eggs on the macaroni while it is drying.

INTRODUCTION

There has been no question that the weevils which attack macaroni are the same ones which attack wheat as cited by Zacker, Cotton, Teichmann and Andres and others, but it has never been determined whether these weevils pass through the processes of manufacture and thus infest the macaroni, or whether the weevils must enter the macaroni in the same way as they enter the wheat, namely by ovipositing in it. The fact that the weevils do lay eggs in macaroni is well known, but their ability to survive the milling of semolina and the process of manufacturing macaroni has been the object of these experiments.

The possibility of the weevils surviving the milling process is dependent upon the ability of the eggs to remain unbroken during the process of milling. Since these eggs are slightly smaller than granules of No. 2 semolina, it is a question as to whether the wheat would break in such a way as to leave the egg in the center of a granule. This is a matter of the chance of a granule breaking off without the line of cleavage following the cavity in which the egg was laid.

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The matter of the weevils passing through the macaroni press depends upon how much pressure the egg could withstand while in the dough. Further than this the egg must of course have remained unhatched from the time when the wheat was milled until the semolina was made into macaroni, unless the weevils were in the semolina and laid their eggs there. All of these questions were taken into consideration in the following experiments.

Part of the work was done at the North Dakota Agricultural Experiment Station because of its facilities for milling semolina. The making of the macaroni was done at a factory in Minneapolis. The rest of the work was done in the laboratories of the Division of Entomology at the Minnesota Agricultural Experiment Station. Every step in these experiments was under the personal supervision of the author from the time the wheat was first obtained until the macaroni had been made and given careful examination. This supervision included transportation of the wheat to Fargo, milling, return of the semolina to Minneapolis, and the manufacture of the macaroni as well as all the work done at the University.

LITERATURE

The possibility of transmitting an infestation of Calendra from wheat to the various hard products manufactured from it, seems to have been left unmentioned in the voluminous literature written on the subject. Zacher, 1918 figures a photograph of[2] *Calendra granaria* attacking macaroni. Cotton, 1920, describes *Calendra oryzae* as attacking macaroni and Teichmann and Andres also list macaroni as among the food attacked by *Calendra granaria*. Durant, Hartley, and Beveridge, 1913 state that they found both *Calendra granaria*, and *Calendra oryza* infesting army biscuits. In the case of these authors it was shown that the weevils must have infested the product after it had been baked. With the exception of this one reference, no reference was found to the possibility of these weevils surviving the process of milling or any of the various processes of manufacturing food products from flour.

Doane, 1918, states that he has found *Calendra granaria* on and in sacks of flour but no statement is made as to whether these weevils entered the flour after milling or not. Furthermore there is no statement as to whether or not these weevils oviposited in the flour.

[2]The generic name *Calendra* was retained in this manuscript altho *Sitophilus* now seems correct.

Experiments with the Milling

Two sets of experiments were performed to determine the possibility of the granary weevils or their eggs surviving the process of milling. Macaroni, spaghetti and other allied pastes are commonly manufactured from semolina, a coarse product from durum wheat. The coarseness of the product varies with the grade and the grades in turn vary from mill to mill. However, the semolina may, in a general way, be compared with the farina of other wheats and it varies from the very coarse "No. 1" to the finer "No. 3," the "No. 2" being the coarsest grade commonly used in making macaroni.

The first set of experiments was conducted with the ordinary methods used in milling semolina on a commercial basis. Twenty bushels of wheat were obtained, which was inspected by the North Dakota state grain inspection laboratory and graded as mixed durum, containing 83 per cent amber durum, 6 per cent red durum, and 11 per cent hard red spring wheat.

The wheat was tempered on January 25, 1922 to bring its moisture content up to 14 per cent which has been found by Dendy and Elkington to be about the optimum moisture condition for development. On the following days adult granary weevils (*Calendra granaria*) were added as rapidly as they could be obtained until the wheat contained an average of 2 weevils to the ounce. The wheat was then kept in 3 covered galvanized iron tanks at a temperature of about 75° F. On January 28th all the weevils had been added and on January 30th many of the weevils were mating.

Samples of wheat were examined daily from this time on and feeding punctures and eggs were found in increasing numbers as time passed. On February 12th, 1922 the percentage of wheat berries infested with eggs had risen to about four. Some of the eggs had hatched but the majority had been laid recently. The wheat was then sacked and shipped from Minneapolis to Fargo where the experimental mill was equipped for the milling of semolina. A sample of one-half bushel of the wheat was kept at Minnesota for a check on the experiment. The wheat was carefully guarded during transit to prevent it from being chilled and when it arrived at the mill the temperature in all of the sacks averaged 59.9° F and the weevils were alive and active.

A check sample was taken out and the remainder was tempered to 15 per cent of moisture and milled on the following day. The adult weevils were removed by screening the wheat and about 300 pounds of No. 2 semolina and about 50 pounds of No. 1 semolina were obtained.

The finer granulations were disregarded because they would be finer than the weevil eggs, consequently the only chance for the eggs to survive would be in the coarser granulations. Pl. 4, fig. 1 is a photograph of a weevil egg surrounded by granules of number two semolina.

The semolina together with the unmilled sample was returned to the Minnesota Agricultural College. The same precautions for protecting the material from the cold were observed as before and the average temperature of the semolina was 61.2° F when it arrived. The weevils in the check samples of unmilled wheat were alive and active.

On February 17th, 1922, 150 pounds of the semolina was made into macaroni as will be described later.

The second milling experiment was performed in a small laboratory mill in the Division of Agricultural Biochemistry at the University of Minnesota with a peck of the sample of wheat which had been retained as a check. This wheat was infested with more weevils from time to time until March 30th. At this time the wheat contained all stages of the weevil; the eggs, larvae, pupae, and adults ready to emerge. Ten wheat berries were selected, each of which contained an egg, and these were milled separately. The peck of wheat was milled first and small samples of material were removed after each grinding to determine to what extent the various stages of the weevils survived. This was to determine whether or not the wheat berries had a tendency to fracture along the egg cavity. Since the possibility for the survival of the egg depends upon the granules breaking off in such a way as to include the eggs within them, a tendency for the wheat berries to fracture along the egg cavities would greatly reduce the possibility for the eggs to survive. In the larger sample, it was found that over 50 per cent of the adult weevils survived the first set of rolls. An examination of the material from the 10 berries showed that only two of the egg cavities could be located and these were in the bran. In one case it could be seen that the inner part of the wheat berry had broken along the egg cavity and the egg could not be found.

No living stages of the weevils were found in the middlings from the first separation although there were many broken parts of legs and other structures of the adult beetles. After the second break a few living weevils were found but after the third break there were no survivors to be found. Samples of material were kept and examined from time to time, but there was no evidence of living eggs.

From the above it is shown that no stages of the weevil survived the

process of milling semolina in these experiments, although the wheat was heavily infested.

Oviposition in Semolina

Many descriptions of the food of the adult weevils include flour as a food substance without distinguishing between substances in which they may sustain life for a certain period and those in which they may live, reproduce and otherwise function in a normal way. Consequently it was necessary to determine whether these weevils might oviposit in the absence of a material too small in size for the construction of the ordinary egg cavity. Three samples of No. 1 and No. 2 semolina were placed in jars and infested with 100 weevils, in each case. The samples were then examined every other day for a month, but there was no evidence of any eggs having been laid and the adults died without leaving progeny. Other weevils taken from the same culture were placed in wheat during this same period of time and they oviposited normally the eggs hatched and the larvae came to maturity. Another 15 pound sample of No. 1 semolina was infested and left to be made into macaroni as will be described later.

In order to determine whether larvae might develop in small granules in case eggs did pass thru the mill or the adults did at times oviposit in granules, particles of wheat were chipped out by hand in such a way that eggs were left in small granules. In these cases the larvae soon broke out of the granules when the inside of them had been consumed. These larvae died due to the fact that they have no legs and were not fitted for life outside of a hard substance. This confirms Cotton's[2] statement that the larvae are restricted to seeds or other foods which contain sufficient food to enable them to develop to maturity. Cases have been observed in which the adult weevils have oviposited in very thin ribbon like noodles. In such cases the adults are apparently deceived by the third dimension of the material. In these cases the larvae either develop into very small adults in case the noodles are thick enough to permit it, or they break out of the material and perish. In such thin material the larval cavity takes on the character of an elongated mine rather than the more or less spherical shape characteristically found in wheat and other grains. This is doubtless due to their reaction when they approach the surface of the material within which they are confined.

This leads to the conclusion that adult beetles could not be induced

[2]Cotton, R. T. 1920. Page 410.

to lay eggs in the semolina. In addition to this it was found that the larvae could not develop in granules like those of semolina even when experimentally placed in such a situation.

The Process of Manufacturing Macaroni

A macaroni press of the ordinary hydraulic type was used in these experiments and the pressure was set to remain between 1,000 and 3,000 pounds per square inch. The factor of pressure as it is concerned in this case is not one of a uniform distribution through the dough. Since only a small percent of the area of the die is perforated, the majority of the dough can not move directly down the cylinder and thru the perforations but must move to the side to be crowded thru the opening. This surging about in the press and readjusting is doubtless the most severe part of the process.

The first experiment was performed on February 17th, 1922, 3 days after the semolina was milled. During the time between the milling and making the macaroni the semolina was kept at a temperature of about 75° F. The dough was mixed in an ordinary dough mixer. The temperature of the water used was 145° F and after 10 minutes mixing the temperature of the dough was 102° F.

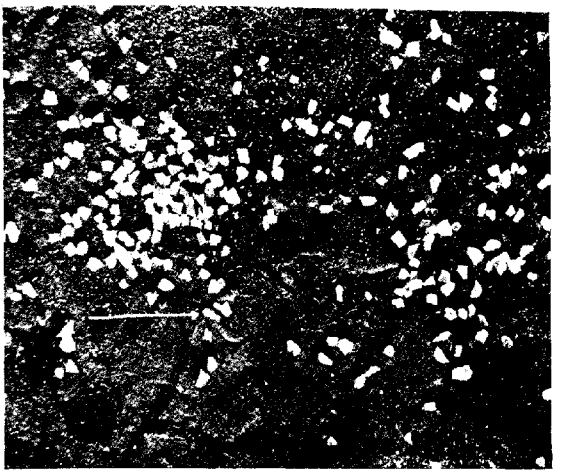
The dough was then kneaded, rolled and pressed. Samples were taken after each operation for examination. In one lot the eggs of the confused flour beetle (*Tribolium confusum*) were placed in the dough just before it was put into the press to determine what effect the pressure would have on these eggs. It was not possible to use the eggs of the granary weevil in this case because they were difficult to obtain free from the wheat. The eggs of the confused flour beetle as described and figured by Chapman, 1918, are of more regular shape than those of the weevil and consequently should withstand greater pressure. Teichmann and Andres describe and figure the egg of the *Calendra granaria* as regularly ovid. Cotton described the eggs of *Calendra oryzae* as varying from ovid to pear-shaped conforming to the shape of the cavity. Hinds and Hunter figure photographs of the eggs of this species showing the general ovid shape. The examination of the eggs of *Calendra granaria* has shown that they vary in shape much like those of

1. Egg of *Calendra granaria* compared with semolina granules. Egg indicated by arrow.

2. Intact eggs of *Tribolium confusum* compared with eggs which have passed thru a macaroni press. Intact eggs at the left and crushed eggs at the right.

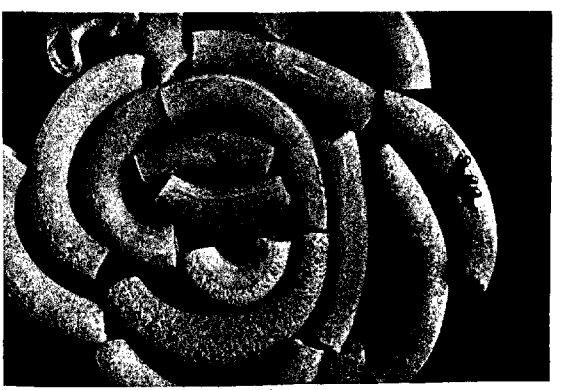
3. Macaroni containing parts of *Tribolium confusum* which were crushed in the press. Intact beetles are shown at the left.

Plate 4



1

2



Calendra oryzae and are not always as regular in shape as Teichmann and Andres describe them.

The macaroni was made into short goods about one inch and a third long. Part of it had a wall thickness of 1/16 inch and the rest about 1/24 inch. The drying was done on trays along with other macaroni in the factory. The air in the drying room was 80° F and the process required 20 hours.

As stated before, samples of dough were taken after each operation and undried macaroni was taken out after each lot had been pressed. These fresh samples were examined the same day but no evidence was found of live eggs of either the confused flour beetle or the granary weevil. The dried macaroni was then examined microscopically and carefully broken apart. The remains of the confused flour beetle eggs were found broken and drawn out of shape and embedded in the walls of the macaroni as illustrated in the photograph Plate 4, fig. 3.

The entire amount of macaroni was kept in carefully sealed cans under the same conditions as the check samples of wheat, one of which had been kept at Minnesota and the other of which had been shipped to Fargo and back. During the last week in March adult beetles were emerging from these check samples of wheat showing that the eggs which had been laid in the wheat had developed and that nothing connected with the experiment had affected them. At this same time the entire amount of macaroni was carefully examined but there was no evidence of weevils in any of it.

The second lot of macaroni was made March 31 in the same way as the first with the following exceptions: the No.1 semolina which had been infested with adult weevils was sifted to remove the adult beetles but to leave in any of the eggs which might have been laid. This and the small amount of semolina which had been milled at the University of Minnesota the previous day from wheat which was known to contain many eggs, was mixed with the remainder of the semolina from the first milling.

When the last lot of dough was about to be put into the press a larger number of eggs, larvae, pupae, and adults of the confused flour beetle was placed in it. Some of this macaroni was collected and examined within a few hours. The rest was dried as before. Upon examination parts of the flour beetles were found, but all were very small and no eggs or other stages were found to be intact (Pl. 4, fig. 3). Furthermore the parts of the beetles were distributed throughout this lot of macaroni showing that the dough surges about in the press.

All of the macaroni was examined after drying but no evidence of live insects had been found even though the macaroni had been kept under observation and carefully examined from time to time.

Conclusions

In the above experiments no stages of the granary weevil (*Calendra granaria*) survived the process of milling semolina even though the wheat was very heavily infested.

The adult beetles did not lay eggs in the semolina even though left in it until they died.

When parts of the wheat were cut away experimentally leaving the eggs in granules similar to those of semolina, the larvae were unable to develop. This is the condition which would arise if eggs did pass through the mill in such granules.

None of the macaroni made from the infested semolina was infested with any insects or eggs even though all the semolina came from badly infested wheat. Part of the semolina had contained adult weevils, and some of the dough had all of the stages of flour beetles placed in it just before it was pressed into macaroni.

This means that macaroni contains no living insects or eggs in any stages as it comes from the press. This is in spite of whether the wheat or flour or semolina may have contained weevils or flour beetles.

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SPREAD OF THE JAPANESE BEETLE, *POPILLIA JAPONICA* NEWM.

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Abstract

The area of infestation by the Japanese beetle has increased from less than one square mile in 1916, when it was first discovered in Burlington County, New Jersey, to 773 square miles at the end of the 1922 season, comprising adjacent portions of Pennsylvania and New Jersey.

It is believed that the spread to date is largely a natural spread on the part of the insect, by means of flight in search of food and suitable breeding grounds. Winds, storms, and waterways are also factors of some importance in the natural spread of the insect.

Artificial agencies are important factors affecting the dispersion of the insect, especially the movement from infested areas of farm products, particularly sweet sugar corn; vehicles of all kinds, and pedestrians traveling through heavily infested districts are also important means of at least local dispersion.

The shipment of infested nursery stock originating in heavily infested portions of the territory is probably the most important means of long distance dispersion of the insect, and this is being guarded against by stringent quarantine regulations.

The Japanese beetle, (*Popillia japonica* Newm.), was first found near Riverton, in Burlington County, New Jersey, in the summer of 1916. Previous published accounts[1] have described the development of the insect from that time, and the work being carried on at the Japanese beetle laboratory. Seven years have elapsed since the original finding of the insect in this country and the data now at hand are sufficient to allow the drawing of certain conclusions as to the spread of an imported insect in a new environment, under the conditions obtaining in the present case. It is the object of this paper to indicate the spread of the insect during the period mentioned, and to discuss briefly some of the factors primarily responsible for the dispersion which has taken place. The data are drawn from the scouting records compiled each year at the Japanese beetle laboratory, and from the personal observation of the writers and other members of the laboratory force.

Yearly Spread

In 1916, the area found to be infested was very small, estimated to be less than 1 square mile in extent. At this time, the beetles were first found feeding on the tips of Crataegus. It was assumed to be a Southern species and no particular efforts were made to determine the limits of the area infested. However, the fact that comparatively few beetles were found, would indicate that the area infested was relatively small, certainly not over the figure given above.

In 1917 a considerable area was scouted and the infestation found

[1]Davis, J. J. N. J. Dept. Agric. Circ. 30, 1920.
Hadley, C. H., N. J. Dept. Agric. Circ. 46–1922.

to cover an area approximately 2.7 square miles in extent, of which about .5 square mile was heavily infested.

In 1918 more intensive scouting was carried out and the infestation was found to have increased to such an extent as to cover an area of approximately 6.7 square miles, as measured on the map. Up to this year the numbers of the insect were still comparatively small, and the spread not to be considered especially extensive in comparison with the spread of later years.

In 1919 the numbers of the insects in the heavily infested area had increased to a point where in the centre of the infested territory, beetles could be found in what may be considered decided abundance. During the summer of 1919, the spread was considerable, and a total of 48.3 square miles was found to be infested. Up to and including this season, no Japanese beetles had been found across the river in Pennsylvania, the entire infestation still being confined to New Jersey.

In 1920 there was again a large increase in infested territory, and for the first time beetles were found across the river in Pennsylvania. It is probable, however, in view of the numbers found there during this season, that the insect had actually reached the Pennsylvania side of the Delaware river during the preceding season, (1919) but in numbers so small as not to have been observed in the scouting of that season. At the end of 1920, the infested area in New Jersey was 92 square miles, and in Pennsylvania 11 square miles, making a total infested area of 103 square miles.

In 1921 the greatest outward spread up to that time occurred. During the summer of 1920, and to a less extent during the preceding summers, strenuous efforts had been made to prevent the spread of the insect, by a program of dusting and spraying around the infested area. However, the spread which occurred, especially during the seasons of 1919 and 1920, had seemed to show that repressive measures as followed were not sufficiently effective to justify their continuation. During the summer of 1921 the beetles had increased in numbers to a very marked extent, and there was an increase in infested area probably in direct proportion to the increase in density. At the end of this season, the infested area in New Jersey amounted to 213.5 square miles, and in Pennsylvania 56.5 square miles, a total of 270 square miles all told.

During the season just passed, that of 1922, there again has been an increase both in density and area of infestation, more or less in direct proportion. The spread has been fairly general in all directions, and

gives now a total of infested area, including portions of both Pennsylvania and New Jersey, amounting to 773 square miles.

Factors Primarily Responsible for Dispersion

Natural Agencies of Dispersion. It is believed that the spread to date is probably largely due to natural agencies. This belief is based on the fact that the rate of spread, year by year, has been fairly constant, in comparison with the increase in numbers of the insects for each year over the previous year. The average yearly rate has been between 5 and 10 miles outward.

The flight of the beetle is probably the most outstanding natural agency of dispersion. The beetle is a strong and vigorous flyer, and is especially active during the hot summer days. Beetles will fly from tree to tree and probably from place to place for some distance in search of suitable food. Early in the beetle season suitable food is in abundance. As the season progresses, and the defoliation of suitable food plants becomes more complete, there is apparently a tendency for the insects to range further in search of food. While it is not possible to say definitely the greatest distance which an individual beetle can fly, experiments have been conducted in connection with this point, during the course of which marked beetles have been recovered at least a mile and a quarter away from the point of releasement. It is not supposed that this distance was covered in one single flight, but more probably in a series of flights. Flight also occurs in the search for a suitable place for deposition of eggs by the female, and it has been noted also that males will accompany females to a certain extent on these occasions. Probably, however, the distance travelled on such occasions is less than when the insects are in search of food.

Dispersion of the insects by winds and storms is probably not an important factor. While it may be true that a few beetles may be carried some distance by strong winds, it has also been noted that normally beetles will fly against rather than with the wind. This fact would tend to limit the distance of flight rather than to increase it.

It is possible that waterways are factors of some importance in the dispersion of the beetle. For example, individual beetles have been picked out of the water of the Delaware River where it flows through the infested territory, at a distance of several hundred yards from the infested shore line. Experiments have shown that the beetles are quite well able to float in water with the current, unless seized by fish or birds. It is quite possible that some beetles may have been carried some dis-

tance in this manner, especially along the smaller streams flowing through the infested territories.

DISPERSION BY ARTIFICIAL AGENCIES. Undoubtedly artificial agencies have played an important part in the local dispersion of the insect. For example, during the inspection of sugar corn, prior to the corn being carried to the market, many thousands of beetles have been removed from the ears of corn. Very often beetles have been found in the husks of the ear, in positions such as to practically insure their carriage, at least to the market where the corn is deposited, unless they have been removed by hand. Beetles have also been found in baskets and other containers in which produce is shipped from the infested area to the market.

Passing vehicles also afford a means of artificial dispersion of the insect, but probably not over as great distances as by the means mentioned in the preceding paragraph. There are many records of findings of beetles on vehicles of all descriptions passing through the infested territory. This fact has also been proven experimentally, as follows: a truck was covered with coarse mesh screen wire, which was smeared over with tanglefoot, and along the sides of which was fastened a trough, also smeared with tanglefoot. During the summer of 1921 this truck was driven over a part of the roads through both the heavily and lightly infested areas; many beetles were caught by the tangle foot on the wire and along the trough, indicating clearly that many beetles would have fallen in the truck had it not been covered by the wire.

The movement of humans on foot in and through heavily infested fields may also result in the artificial dispersion of the insect locally. For example, beetles have been removed from the clothing of men working in infested orchards after they have left the orchard; beetles have also been removed from the clothing of pedestrians walking along the roads and paths, or through fields, in the heavily infested districts.

Artificial dispersion over long distances is most apt to result from the shipment of infested nursery stock. All evidence at hand seems to show beyond reasonable doubt that the original infestation in this country resulted from the importation of stock from Japan, namely iris or azalea, with the soil about the roots, infested with the larval stage of the insect. Several similar cases have come to the attention of the writers, where imported stock of this character has been found, upon examination, to carry living larvae of Anomala or other related groups. Experience with nurseries located in the beetle infested area has shown that stock commonly shipped with soil around the roots, such as potted

stock and the various conifers, can very easily carry living larvae in the soil and matted roots to any distance over which the stock itself can be safely shipped. Stringent quarantine regulations affecting the shipment of nursery stock from infested territory have been, for several years, and are now being enforced by the Quarantine division of the Japanese beetle laboratory staff; so far as is now known, these regulations have been effective in preventing further dispersion through this means.

THE EFFECT OF LEAF-HOPPER INJURY ON THE SUGAR-CONTENT OF GRAPES

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Abstract

The grape leaf-hopper, *Erythroneura comes* Say, is a major pest in the vineyards of the Pennsylvania grape belt along Lake Erie. During seasons of high leaf-hopper infestation, the grapes do not ripen properly. This condition seriously reduces the market value of the grapes for table use and for the manufacture of juice. The extension department of Pennsylvania State College is furnishing a spray service to the grape growers for the control of vineyard insects and diseases under the direction of the author. The effect of a nicotine spray on the leaf-hopper, under the high leaf-hopper infestation found during the season 1922, was determined by a comparison of the sugar-content of grapes (as indicated by the Brix spindle) that received the nicotine spray with grapes that were not sprayed. The conclusion is that, in a season of severe leaf-hopper infestation, a nicotine spray applied to the vines during the period when the maximum number of nymphs of the first generation of leaf-hoppers are present, will permit the production of grapes of table quality. The work also demonstrates that the sugar-content of the grape juice, under conditions of high leaf-hopper infestation, is an index to the efficiency of the control measure.

The primary injury to grapes by the leaf-hopper, *Erythroneura comes* Say, is the effect upon the quality of the product. Fruit from vines infested with leaf-hopper is low in sugar content, inferior in flavor, and improperly colored. Such grapes are not suitable for the table-grape market and are not wanted at the grape-juice factories. If any large proportion of the production is of such quality, the crop moves slowly at a low price. In a season of high leaf-hopper infestation the production of grapes of table quality depends upon efficient leaf-hopper control.

There are numerous records relating to the effect of leaf-hopper injury upon the quality of grapes. Harris, 1841, (1) refers to the exhaustion of grape vines by the continued interruption of the important functions of the plant due to the feeding of the leaf-hopper. Slingerland, 1904, (2) states that leaves badly injured by the grape leaf-hopper die permaturely, thus preventing the proper coloring, ripening and sweeten-

ing of the fruit. Hartzell, 1910, (3) calls attention to the non-ripening of grapes and their poor quality due to leaf-hopper infestation. Johnson, 1911, (4) says that foliage badly injured by the grape leaf-hopper cannot elaborate the sugar of the fruit. Hartzell, 1912, (5) further considers the nature of the injury to grapes by the leaf-hopper as indicated by the quality of grapes from infested vineyards, and in 1913, (6) reports on analyses of grapes from vines sprayed with nicotine and from non-sprayed vines. Johnson, 1914, (7) again refers to the arrested functioning of the foliage by injury due to the grape leaf-hopper and says this has a tendency to check the development of the entire vine, the size of the crop of fruit is reduced and the quality is rendered inferior by a reduction of the sugar content. DeLong, 1922, (8) referring to grape leaf-hopper injury in Erie County, Pennsylvania, says that many growers were refused markets for their grapes in 1920 on account of the red appearance and the sour flavor of the partially ripened fruit.

In the report by Hartzell in 1913 he considers that the most important loss to the grape growers from leaf hopper injury arises from a depreciation of the quality of the fruit, that Concord grapes normally have a bluish-black color when ripened but that fruit from leaf-hopper infested vines has a red appearance, a decided lack in flavor, and shows a decrease in sugar content and an increase in acid. He found by analyses a consistent gain in sugar content of grapes from a series of plots sprayed with nicotine as compared with grapes from non-sprayed vines. This increase in the sugar content, due to the control of the leaf-hopper varied from a minimum of 8.4% to a maximum of 68.1%. The increase in the sugar content of the grapes from the sprayed vines varied directly with the amount of leaf-hopper infestation, the lower increase being from vines less infested. The grapes from the vines protected from leaf-hopper injury had a higher sugar content, a lower percentage of acid and a darker color than those grown under identical conditions but subjected to the leaf-hopper attack.

The high leaf-hopper infestation throughout the vineyards in the Pennsylvania section of the grape belt this season emphasized the need of control measures for this insect. A nicotine spray was included in the spray service of the College. This was applied on six demonstration plots in typical locations throughout the section at the time the maximum numbers of nymphs of the first generation were on the vines. It consisted of ½ pint of nicotine sulphate 40% to 100 gallons of water, with either resin fish-oil soap (3 pounds) or lime (10 pounds), and was

applied to the under sides of the leaves under strong pressure. The plots were sprayed July 17th to 19th, inclusive.

In the grape section under consideration, there was an average infestation of 64.25 leaf-hopper nymphs per leaf on the maximum infested vines, including both upper and lower leaves, at the time the nicotine spray was applied. Twenty-four hours after the nicotine spray was applied, a count of tagged companion leaves on all the plots gave an average of 18.37 nymphs per leaf, a reduction of 71.40% in the numbers due to the nicotine spray.

The analyses of grapes made by Hartzell in 1913 suggested to the writer that the sugar content of the grapes in the demonstration plots receiving the nicotine spray, would be an index to the efficiency of this control measure. Readings by the Brix spindle were taken of the juice from composite samples of grapes from all the plots. The amount of nicotine and the time of application were the same for all the plots. There was a variation in the method of application, in the amount of leaf-hopper infestation, in the pressure maintained, in the extent of vine growth, and in the height of the foliage on the wires above the ground. The composite samples were taken (1) from the portions of the plots indicating maximum leaf-hopper infestation, and (2) from portions a reasonable distance from such locations. In addition to the composite samples from each of the plots, selected samples were taken from vines showing the best production and condition of the fruit. The following table gives the results of the Brix readings of the juice from the grape samples taken from the six plots.

TABLE I. BRIX READINGS, NICOTINE SPRAYED GRAPES, CONCORD VARIETY

Vineyard	Brix Reading.			
	Composite samples.			Selected samples.
	1st.	2nd.	Average.	
Luce	17.89	15.77	16.83	17.94
McCord	16.19	17.29	16.99	17.39
Southwick	17.99	17.67	17.83	19.07
Bostwick	16.87	19.07	17.97	17.97
Pierce	19.07	19.27	19.17	20.17
Bernet	19.87	20.27	20.08	19.57
Average of totals.	18.06	18.22	18.14	18.68

The above readings indicate a sugar content well above the requirement for grapes of table quality. The color of the grapes varied from dark-blue to blue-black. The average reading for the composite samples was 18.14 and the average reading for the selected samples was 18.68, showing only a slight difference in the quality of the grapes taken at random in the more infested portions of the vineyards and in those selected for their good appearance and condition.

The demonstrations do not show what would have been the quality of the grapes had the nicotine not been applied to the vines. Such a contrast is given in the analyses of Hartzell in 1913 between the sprayed and non-sprayed grapes in his series of experiments. His comparisons apply only to the seasonal conditions under which his experiments were carried out.

An opportunity was offered for a comparison in the Erie County work this season. In one vineyard, apart from the demonstrations, a block of grapes did not receive the nicotine spray while a block directly across the alley was sprayed with the same outfit used in the treatment of one of the demonstration plots. All the conditions in the sprayed and unsprayed blocks were otherwise identical. At harvest time samples from the sprayed and non-sprayed vines gave the following readings of the Brix spindle.

TABLE II. BRIX READINGS, SPRAYED AND NON-SPRAYED GRAPES, CONCORD VARIETY

Janes vineyard.	Brix Reading			
	Composite samples			Selected samples
	1st.	2nd.	Average	
Sprayed.....	18.67	16.87	17.77	18.44
Unsprayed	13.69	14.29	13.99	15.79
Difference.....	4.98	2.58	3.78	2.65

In the average readings of the composite samples of sprayed and non-sprayed grapes there is a difference of 3.78, which indicates an increase of approximately 27.01% in the sugar content due to the control of the leaf-hopper by the nicotine spray. The season was very favorable for ripening the grapes but the color of the grapes from the non-sprayed vines was reddish purple while those from the sprayed vines varied from dark-blue to blue-black. The results of these comparative readings show that the high sugar content on the demonstration plots was due to leaf-hopper control and that the sugar content of grape juice,

under conditions of serious leaf-hopper infestation, is an index to the efficiency of the control measure.

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A HOUSE FLY PLAGUE IN THE AMERICAN EXPEDITIONARY FORCE[1]

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ABSTRACT

The house fly became a serious danger to health during the summer of 1918 at one of the camps of the 20th Engineers (Forestry) at Lamanchs, Department of the Landes, southwestern France. A location that should have been unusually healthful was transformed into a place of pestilence through neglect of sanitation. A severe epidemic of dysentery was followed by epidemic influenza and pneumonia, and there is strong evidence to support the belief that the fly-borne dysentery was largely responsible for the severity of the influenza among the main body of troops at Lamanchs. Although commissioned entomologists would have encountered substantial difficulties, it is felt that a great deal of good would have been accomplished by qualified men applying preventive and remedial measures at the proper time.

During the year 1918 the writer had an opportunity to observe the lack of fly control in one of the permanent camps of the A. E. F., in the southwest of France. The company of which he was a member (11th Company, 20th Engineers, Forest) went into permanent camp at a spot known as Lamanchs, three miles north of the small seacoast town of Mimizan-les-Bains (Landes) on January 27th. Lamanchs is about in the center of the sand dune belt which borders the Bay of Biscay for nearly 100 miles, the belt being six miles wide at that point. The dune

[1]The facts given are from memory and from the diaries of Attorney F. A. Lind, Seattle, Wash., (formerly first sergeant), and the writer. The substance of this paper was written in 1920 and at that time copies were submitted to Mr. Lind and to Mr. C. T. Dodds, now entomologist with the United Sugar Cos., Los Mochis, Sinaloa, Mexico, and the writer is indebted to both for criticisms and corrections. Mr. Lind and Mr. Dodds were active in studying the causes and possible palliative measures in connection with the fly plague.

region was afforested artificially in the nineteenth century and today presents perhaps the world's finest example of afforestation, having been converted from an encroaching waste of sea sand to a profitable area yielding turpentine, lumber and fuel. Here a number of units of American forest troops found supplies of suitable timber sufficient for company months' operations.

The camp site at Lamanchs is ideal from the standpoint of health and sanitation. The drainage in the dry sand is perfect. There are no streams or pools of standing water in the entire local dune region and mosquitoes are rare. Excepting one farmhouse two miles to the west there is no human habitation nearer than Mimizan-les-Bains. The climate is mild, the rains occurring mostly during the winter months, and snow seldom falls. The heat of summer is moderated by steady winds from the sea. Very little of the area is level and a uniform stand of maritime pines covers the dunes which consist of long ridges parallel to the coastline, and which attain a maximum height of 100 feet at their crests.

Lamanchs was [illegible] arrival, being merely a loading point for lumber and turpentine on a branch of the Southern Railroad.

After some weeks, sanitary arrangements for the company's camp were installed. A shower bath, a covered mess hall and kitchen combined with refrigerator, a covered well and a meat storage house. During the first month latrine trenches were used, followed by the erection of a large box latrine about [illegible] in accordance with general orders received. This covered latrine consisted of a pit about 30 or 6 feet and 8 feet deep, covered with a box with a roof above and partly open sidewalls, six small latrines were constructed at convenient places about camp.

The food conservation projects undertaken by the company were a garden (in accordance with general orders) and a few hogs (voluntary) for the disposal of garbage. The hogs were kept in a pen 30 feet square in a corner of the mule corral, 200 yards west of the mess hall. From the start of the operation no trouble was experienced from fly breeding in the fifth of discarded food cans, these being buried clean in the incinerator pounded flat and stored for future use as a source of iron. Cleanliness was enforced about the company street and living quarters.

The mule stable, housing 62 head, is believed by the writer to have been conducted in a sanitary manner. Some of the manure was spread on the garden plot, and the rest used to improve the wearing qualities of the sandy woods roads. During the hot months the manure dried rapidly and was removed daily. Several inspections by the writer and

Mr. C. T. Dodds, a man with entomological training, failed to indicate the stable as a source of flies. The men's drinking water was supplied from two Lister bags, care being taken to chlorinate it whenever fresh water was put in. Personal cleanliness was the rule in camp and no cases of pediculosis in 1918 were reported, except two or three cases prior to the installation of the shower baths.

The men were careful about the disposal of excreta in the neighborhood of the camp. This was practically never deposited in the nearby woods, and during the period when open trench latrines were employed the sandy nature of the soil made it possible to push a large amount into the trenches with one turn of the foot and this matter was observed conscientiously by the men.

A small amount of fly breeding possibly occurred at the buckets where mess kits or dishes were washed, but was not observed in our inspections. Here the garbage receptacles sometimes were filled to overflowing, and water splashed or leaking from the wash buckets kept the sand moist.

The flies (principally *Musca domestica* L.) began to be numerous before the middle of June. By the last of the month they were very bad. It was found impossible with the limited amount of wire screening on hand to fly-proof the mess hall which had been built of green lumber. About the time the swarms of flies appeared the men were eating from dishes (instead of from mess kits) and helped themselves from cans placed on the tables before mess call. The flies simply swarmed over the food, and newspapers laid over the food dishes proved nearly useless as a protection. The non-commissioned officers' mess was served in a small room next to the kitchen where the flies were particularly bad. Before the mess call [illegible] over the food [illegible] the kitchen [illegible] the [illegible] strips and [illegible] hanging [illegible] the other [illegible] keep the flies away [illegible] traps placed by Mr. Dodds at the two windows, [illegible] comparatively few [illegible] the only light entering the room [illegible] the traps but the flies preferred to remain inside.

Similar traps were placed over holes in the large latrine and great numbers of flies which probably matured in the pit below, were caught. It was out of the question to cover all the cracks left by the drying lumber or to construct the lids to prevent the passage of flies. Thousands of flies remained at rest on the rafters and roof boards, particularly in the evening, and an attempt was made in desperation to kill them with a blow torch. This treatment resulted in few deaths as the flies fell off with only their wings burned and crawled about, a worse nuisance than

before. Straw was burned in the pit at intervals but probably did little good as a temperature sufficient to sterilize the pit would have ignited the superstructure. A thick oil was supplied the camp for sanitary purposes but it was so viscous that the spray pump delivered a thin stream only and could not have been efficient as a means of preventing fly breeding in the pit. The small latrines received no better or worse attention.

Some of the men purchased cloth netting as a protection while sleeping, and a few strips of tanglefoot were used. The interiors of the cook's tents next to the kitchen were black with resting flies in the evening and the cooks at last were forced to abandon the location. The meat served was usually in a state of partial putrefaction; for weeks the men took little or none of it, much as they needed nourishing food at this time. Quarters of beef were sometimes dumped into the sand from the supply train and at times lay in the sun for half an hour, inviting the oviposition of blow-flies. The meat house was not fly tight, blue-bottle flies being at work there, and eventually a new house with walls and door of wire cloth was substituted. There was no refrigeration at the camp.

Beginning shortly after the middle of June and lasting throughout July the company was visited by an epidemic of dysentery. This disease attacked nearly the entire command and greatly weakened the men, some of whom were removed to the infirmary at Mimizan-les-Bains for treatment which consisted of a diet, principally of black coffee. Some days as many as thirty men reported at sick call in the morning.

Conditions about the kitchen steadily got worse. The drinking water from the driven well had a strong and disagreeable odor and the atmosphere about the building was such that the mess sergeant, who had his quarters there, was forced to move. Finally the kitchen floor was taken up and the cause of the condition found to be the overflow of the covered cesspool which had backed up over the whole area of the kitchen. The pipe of the driven well (about 25 feet deep) went down through this gray greasy liquid. A new well was put down about 20 feet from the old one and another sink hole was dug nearby. It is probable that the cesspool overflow served as a prolific source of flies and the strong odor probably accounts for the difficulty experienced in ridding the building of the pests.

General orders called attention to the prevalence of dysentery in the region and suggested various precautions to be taken against flies,

including the fly-proofing of mess halls. More or less thorough attention was paid the matter by the district health officer whose opinion that the flies bred in the dry sand was voiced in the writer's hearing. Mr. Dodds and the writer made a number of inspections of the camp and concluded that the main source of flies was the hog pen. The sand of the pen being impregnated with moist filth offered ideal breeding conditions and produced a constant and very large supply of flies. Thousands of newly-emerged individuals could be found drying their wings upon the moss outside the pen and the prevailing winds made the direction of the mess hall the course of least resistance. The district health officer was surprised to learn of the existence of the hog pen, but took no action. By showing puparia to the company commander and by loaning fly-control literature to the officers of the company the removal of the pen was accomplished—to another corner of the mule corral. The commander had the area of the old pen burned over, but examination showed this to be effective apparently to a depth of three inches only.

During the hot weeks visiting inspectors called occasionally at the camp, made hurried inspections, gave a little advice and usually considerable praise, and departed. Late in July the first case of Spanish influenza broke out in camp; on August 5th the disease was epidemic and on the 10th reached its climax, on which date 188 men of the 207 present strength of the 11th Company were sick. Only 3 or 4 of the company escaped the disease, and nine died, but of a detachment of 55 of the 45th Company, 20th Engineers, attached to the 11th Company, *not a man had the influenza.* This detachment worked and ate with the 11th Company and had tents close by, but they had been subjected to an insufficient diet for a period five months less than had the 11th Company.

During the epidemic of influenza the flies were almost intolerable. Men without mosquito netting had to sleep entirely covered with a blanket notwithstanding a high fever. The sides of the tents were rolled up to admit air and the sick men lay in their bunks and expectorated onto the sand, the sputum attracting the flies. A few of the men developed well-pronounced cases of pneumonia before their removal to the infirmary was accomplished, and the flies clustered upon their lips while sleeping uncovered.

The regiment of which the 11th Company was a small part was the largest in the Army, consisting of over 18,000 men separated in about 80 different camps throughout France and operating, when at maximum activity, 107 sawmills. From the data secured by the writer in con-

nection with the preparation of the history of this regiment it seems probable that the influenza epidemic at Lamanchs was the most severe in the entire command.

While there is no experimental evidence on the relationship of the house fly to the dysentery epidemic at Lamanchs, the general acceptance of the fact that flies are vectors of the disease is sufficient to warrant the flies being charged with its spread there. If we ignore the possibility that the flies had anything to do with disseminating the influenza and pneumonia organisms, we can still indict the insects with being a very important contributory cause of the epidemic of the latter diseases. The debilitating effect of dysentery, added to the weakening results of months of hard labor with insufficient food, accounts, in the writer's opinion, for the really startling fact that the 11th Company was 98% sick with influenza and pneumonia and the 15th Company Detachment showed a susceptibility of zero. Both had dysentery, but in the case of the 11th Company the effect of the disease was to lower the resisting power below the danger line.

No other interpretation of the situation has ever occurred to the writer. Immediately following the dysentery, the men were in a condition of subnormal vigor and their physical stamina collapsed in the presence of epidemic influenza. It may also be noted that the effect of the flies in rendering the food unappetizing, and therefore further restricting the inadequate diet, was considerable.

To whatever value may be placed on the lives of the 11th Company men who died should be added the expense of training and transporting them to France, the lost value of 9 months' services and $90,000 war risk insurance which they carried. The crippling of the operations at Lamanchs through dysentery and the entire cessation of work during the influenza epidemic are also largely chargeable against the house fly.

In the 20 years of house fly research and publicity which have elapsed since Reed, Vaughan and Shakespeare published their report on sanitary conditions in the training camps in the United States during the Spanish war, [illegible] conditions were practically duplicated at Lamanchs and [illegible] also difficult to write a dispassionate account of them. The consequences were different, however, and there was no typhoid.

The information published in general and special orders on camp sanitation received at Lamanchs were from three principal sources: headquarters of the Base Section of the Services of Supply, and of the

and these were in accord with the best information. The trouble lay in their enforcement, and the fact that the subject of one official order was the epidemic nature of the dysentery and warning against flies indicates that the regulations were poorly enforced throughout the whole region of southwest France.

We must not assume too readily that as commissioned entomologists overseas we would have remedied all this. Early in 1918, when there were few flies, other things seemed more important. Fly control means work, and at that time the great need of the engineer troops in the rear was man power. The forest troops were working in shifts, 24 hours a day, racing with one another to meet the insistent demands for more lumber and ties, and it was no simple matter to get company commanders to give much attention to sanitary improvements.

But the writer feels that with commissioned entomologists assigned to groups of camps much that was unfortunate would not have developed. Energetic and insistent men could have accomplished a great deal with relatively little work, *done at the right time*, and such service would have paid dividends, both in money and in the increased comfort, efficiency and safety of the soldiers.

COLOR MARKING OF THE STRIPED CUCUMBER BEETLE (*DIABROTICA VITTATA* FAB.) AND PRELIMINARY EXPERIMENTS TO DETERMINE ITS FLIGHT

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Abstract

The wide spread depredations of the striped cucumber beetle, including both its feeding injuries and its rôle in the transmission of bacterial wilt and mosaic of the cucurbits, has been estimated to damage the crop to the extent of $3,000,000 to $5,000,000 a year in the United States. Many of the recognized control measures in the past have been of little or no value in killing the beetle, and their virtue as repellents has depended upon repeated applications to the growing crops because the beetles are constantly flying from field to field.

This project was undertaken to find the limits of the powers of flight of the beetle and its normal habits of migration.

After experiments with various dyes and coloring substances covering a period of three years, the most successful material for marking has been found to be six parts, by volume, of denatured alcohol (denatured with methyl alcohol), four parts of commercial cut shellac, the mixture colored with a saturated solution of various aniline dyes in alcohol. This material may be sprayed on the beetles with an atomizer, dries quickly, adheres well to the body of the insect, retains its color indefinitely; and does not appear to interfere in any way with the normal functions of the insect.

During the summer of 1922 three lots of beetles totaling 25,780 individuals, were marked and released. Of these, 49 were recovered after an average interval of 4½ days. They flew an average distance of one-half mile, five flying over a mile each. The project is to be continued during the season of 1923.

KNOWLEDGE OF THE INSECT'S HABITS OF FLIGHT NECESSARY FOR CONTROL

The widespread depredations of the striped cucumber beetle and the need of adequate control measures are too well known to require mention here. The purely mechanical injury which it causes in its feeding is not the only offence laid at its door. The rôle of the beetle in the transmission of certain cucurbit diseases, as shown by recent investigators, proves it of even greater economic importance. The beetle not only disseminates cucurbit mosaic, but is also the chief if not the only carrier of the bacterial wilt of cucurbits. The damage caused by the beetle has been variously estimated at from $3,000,000 to $5,000,000 a year. Many control measures have been suggested and tested, some of which have proved effective in killing or repelling the beetles present, but none could be recommended as a complete control. The lack of efficiency has been due chiefly to the migratory habits of the beetles, for although they may be completely destroyed or driven away from a treated area, migration from surrounding untreated plantings will soon reestablish infestation. This project was undertaken, therefore, to define the limits of the powers of flight of the beetle; the maximum and average distance covered on the wing, and the frequency with which the beetle migrates from one planting to another.

EXPERIMENTS IN MARKING

Experiments in marking beetles were begun in 1920, considerable time being devoted to finding a material and a method which would allow rapid and successful marking. The principal difficulty was in securing adhesion of the marking colors to the elytra. Among the substances tested were glue, colored chalks, aniline dyes, India inks, and shellac, and although tested singly and in various combinations, all proved unsuitable. Glue, dyed with an India ink, dried so slowly that beetles marked with it soon became entangled and incapable of flight. Colored chalks, which had been used successfully by other workers in marking bees and many Diptera, failed to adhere to the almost hairless bodies of the beetles. Aniline dyes or India inks, used without an adhesive, were almost indiscernable on drying. Commerical shellac had the same objectionable qualities as glue. The pigment finally employed was a precipitate resulting from thoroughly mixing two parts shellac and one part of various India inks. This precipitate was very adherent to the elytra of the beetle. It retained its color well and dried quickly but could not be suitably applied except by means of a small

camel's-hair brush. In order to make the normally very active beetles more easy to handle while being marked, a method of chilling by placing them in test tubes in ice water was employed. By this process the beetles were marked effectively. It was used also with complete success by N. F. Howard at Birmingham, Ala., in marking the Mexican bean beetle. This method, however, is very laborious, about 2,000 beetles per diem requiring two men's work. The principal problem during the season of 1922 was, therefore, to find some equally good marking agent which could be applied with much greater rapidity.

A coloring agent was finally produced by diluting shellac with alcohol, using alcohol-soluble aniline dyes as the coloring matter. The most satisfactory solution was one composed of six parts alcohol and four parts commercial shellac, colored with a saturated solution of the aniline dye in alcohol. This dried quickly, adhered well to the body of the beetle, retained its color indefinitely, and did not interfere in any way with the normal functions of the insect. An added advantage of the diluted shellac over former materials used was that it could be sprayed on the beetles with an atomizer. This material also provided a very effective marking agent for other insects, especially for bees. Bees marked with a solution of seven parts alcohol and three parts shellac dyed with aniline green, remained vividly colored seven days after they had been marked. A solution of eight parts alcohol and two parts shellac with aniline green as the coloring agent proved satisfactory for house flies and the potato aphis, the color being particularly conspicuous on the wings.

Present Technique of Marking and Recovery

The technique of marking beetles, liberating, and recovering them, has developed as the work progressed and no doubt will be still further perfected, but a most satisfactory method followed at present is here described: A large number of beetles, five to ten thousand or more, is collected from the field. The problem of collecting beetles is very simple after the first squash blossoms of the season appear, due to their decided preference for pollen. On these they congregate in large numbers and it is only necessary to gather the staminate blossoms to collect a great many beetles. The collected blossoms are placed in numbered ten-pound paper sacks. All the blossoms from a certain garden are placed in one sack and a note made as to the number of the sack and the name of the owner of the garden. The sacks are brought to the laboratory and opened, one at a time, in a field cage.

This method of collecting beetles in the field serves two purposes, to recover marked specimens and to obtain a supply for marking. As the beetles emerge from the sack any marked ones can be easily distinguished and captured. When a marked beetle is found, the color with which it is marked determines the point at which it was released, while the number of the sack from which it issued gives the location of its collection.

The unmarked beetles collected in the large field cage are transferred to a small cylindrical screen cage 2 inches by 7 inches and then taken, as needed, to test tubes which are graduated at the points to which 100, 200, 300, 400, and 500 beetles (by actual count) will come. In this manner, an accurate estimate may be made of the number of beetles to be marked without an actual count. A field cage is used in which to mark the beetles. It is fitted on each side with cloth containing head and arm holes and has an 20-mesh screen bottom. By employing this type of cage, it is possible for two operators to work at one time and mark more accurately and quickly. One operator shakes the beetles, about thirty at a time, from the test tube on the platform and then sweeps them from the platform to the floor of the cage, after the other operator has sprayed them with the colored solution. The marking platform is a box of screen 2 inches by 4 inches by 1 inches set in the center of the cage. The beetles are marked on this platform and then swept immediately from it, in order to avoid giving them two coats of the spray material. If not over thirty beetles are shaken from the test tube to the platform at one time, it is possible for the person operating the atomizer to spray all of the beetles before they can escape. All marking is done out of doors in order that the shellac may dry more quickly and to prevent the operators from inhaling more of the spray than necessary. The marked beetles quickly crawl up the sides of the screen cage which facilitates the drying of the shellac. When all the beetles available at one time have been marked, they are taken in a cage to some predetermined spot, either in a cucurbit garden or some distance from one and released. The cages are visited about 24 hours later and all beetles, which have not flown away, are counted and subtracted from the number marked. Therefore, the "number released" is the actual number which fly, or possibly crawl, away.

Experiments in Flight

During the summer of 1922, three lots of beetles totaling 25,586 individuals were marked and released. The results obtained are given in the following table:

TABLE I. GIVING RESULTS OF THE RELEASE AND RECOVERY OF THREE LOTS OF MARKED BEETLES. MADISON, WISCONSIN, 1922.

Experiment 1 Aniline Green Marked Beetles				Experiment 2 Aniline Blue Marked Beetles				Experiment 3 Gentian Violet Marked Beetles			
Number Released 3234				Number Released 18019				Number Released 4533			
Date Released July 12				Date Released July 20				Date Released July 31			
Place Released No. 12 (On map)				Place Released No. 35 (On map)				Place Released No. 14 (On map)			
Number Recovered	Place recovered (On map)	Interval (Days)	Distance Flown Miles	Number recovered	Place recovered (On map)	Interval (Days)	Distance Flown Miles	Number recovered	Place recovered (On map)	Interval (Days)	Distance Flown (Miles)
1	10	3	.48	1	13	1	.38	2	13	2	.18
1	3	5	.43	9	4	2	.20	1	20	2	.83
4	4	5	.42	2	3	2	.55	1	22	2	1.40
1	10	6	.48	3	15	4	.38	1	8	4	1.15
1	8	7	.91	2	3	6	.75	1	23	4	1.34
1	4	10	.32	3	8	[illegible]	.35	1	23	7	1.34
2	3	10	.43	2	4	7	.30	1	20	7	.83
2	10	12	.48	1	3	9	.55	2	11	8	.60
1	3	15	.43					1	4	14	.79
1	2	15	1.70								

Experiment No. 1 was conducted with beetles marked with aniline green. 3,234 beetles were released, of which 15 were recovered. The average interval was 8–⅓ days and the average distance from point of liberation was .52 miles. One beetle was recovered 1.7 miles from the point of liberation. This was the longest distance observed in any of the experiments.

Experiment No. 2 was conducted with beetles marked with aniline

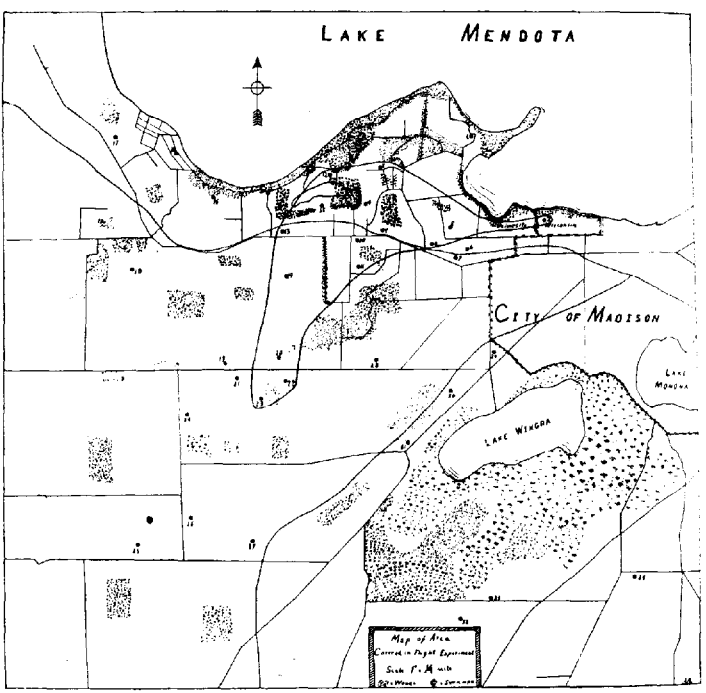

Fig. 3.—Map of area covered by flight experiments.

blue. 18,019 beetles were released, of which 23 were recovered. The average interval was 4 days and the average distance was .38 miles from point of liberation.

Experiment No. 3 was conducted with beetles marked with gentian violet. 4,533 beetles were released, of which 11 were recovered. The average interval was 5–½ days and the average distance from point of liberation was .83 miles. Four of these beetles flew over a mile each.

SOME EXPERIMENTS ON POISON BAITS FOR THE EUROPEAN EARWIG

By B. B. Fulton, *Oregon Agricultural Experiment Station*

Abstract

As a stomach poison for the European Earwig, sodium fluoride has an equal or greater amount of toxicity than arsenious oxide and acts more rapidly.

Wheat bran sweetened with molasses is sufficiently attractive to the earwigs for all practical purposes.

The addition of amyl acetate does not increase the attractiveness of the sweetened bran for earwigs.

Oat hulls are slightly more attractive than wheat bran. The adhesive property of the former makes it especially desirable for a bait to be applied to objects for poisoning half grown or adult earwigs, but not so good for scattering over the ground for young earwigs.

Glycerin does not lessen the attractiveness of a bait and increases the length of time during which the bait is effective.

The European Earwig (*Forficula auricularia* Linné) which has become an established pest in Rhode Island and in several cities of the Pacific northwest, has been found to be susceptible to poison bait control methods. Stale bread crumbs have been recommended for this purpose[1] but this material is difficult to prepare and scatter and is undesirable for large scale operations. Preliminary experiments showed that wheat bran was readily taken by earwigs when attractive materials are added, and since this is one of the best mediums from a practical standpoint, being easily mixed and scattered, it was adopted as a base for further experiments conducted in Portland, Oregon, during the summers of 1921 and 1922.

Tests of various poison bran mixtures made during the first season's work showed that earwigs are very resistant to arsenical poisons. Arsenious oxide or white arsenic in proportions two or three times as great as commonly used for grass hopper control required from two and a half to five days to cause death. Other tests were made using sodium fluoride as the poison and in every case death resulted much more rapidly than where an equal amount of arsenious oxide was used.

In all of these preliminary experiments a large element of error existed due to the fact that the insects used in the tests were collected from open piles of the poison bait and there was no way of telling how long they had been feeding. For this reason only very general conclusions could be drawn from the data.

For the experiments during the following season a small trap cage was devised which acted on the principle of a fly trap. The bait to be tested was placed in a small tight box with a screen front bent inwardly in the form of a wedge and having small holes at the innermost point of

[1] D. W. Jones. U. S Dept. Agriculture, Bulletin 566.

the screen. Earwigs attracted by the bait would readily enter and feed, after which they would seek a place to hide and find a darkened glass vial provided for that purpose. The earwigs were collected the following morning and kept in quart jars with cheese cloth covers and provided with plant food.

The following proportions of poison materials were used on the basis of four pounds of wheat bran:

Sodium fluoride (technical) 1, 2, 4 and 8 ounces.

Calcium fluoride (powdered fluorspar) 1, 2, 4 and 8 ounces.

Arsenious oxide (technical) 1, 2 and 4 ounces.

Sodium arsenate (technical) 2, 4 and 8 ounces.

All lots were moistened with a like mixture of molasses and water.

In Table I have recorded the total number of earwigs captured in each test and the number of dead found in the cages each morning following the evening during which the traps were baited. Since the baiting was done early in the evening, the counts on the first morning are approximately twelve hours after the poison was taken. On the second morning, a day and a half, and so on. Where a blank space occurs in the table after previously recorded dead, it means that no count was made on that day.

When these figures have been reduced to percentages and plotted out as a curve, a much better idea of the relative killing value of the different mixture can be obtained. This is shown in chart I. In order to avoid crowding, the series of sodium arsenate and the one lot of calcium fluoride in which marked killing resulted are plotted separately with the one curve of arsenious oxide dotted in for a basis of comparison. In the jars to which the earwigs were confined it was quite noticeable that those which had taken calcium fluoride were quite active, ate the leaves provided for food and were practically normal. In all other lots the insects were sluggish and did no feeding except a very little at first by those baited with the lower strengths of arsenious oxide.

It will be noticed that sodium fluoride at 2 ounces to four pounds of bran was approximately equal in speed of killing to arsenious oxide at 4 ounces, although in the former case one individual living over, caused the upper end of the curve to be extended four days. A comparison of the curves of sodium fluoride one ounce and arsenious oxide one ounce shows that at this dosage the former was much more effective. Calcium fluoride was the least poisonous of the materials used and in all proportions except eight ounces to four pounds, had little effect. The earwigs lived over ten days with no material decrease in number, while at twenty days a considerable proportion had died through over crowding and my neglect to feed and water them properly.

The curves for sodium arsenate show that while this substance acts rapidly it is not as poisonous or at least no more poisonous than arsenious oxide.

Sodium fluoride costs no more than arsenious oxide, at least when purchased in small quantities, and has certain advantages for use in a poison bait mixture. It is very soluble in water and does not need to be mixed with bran dry, as in the case of arsenious oxide. It can be dissolved in water with the attractive ingredients of the bait and any amount of bran desired for immediate use can be wet with this mixture and applied. It has marked antiseptic qualities so that mixtures containing it will keep indefinitely. It is also less toxic to humans than arsenious oxide. Sodium fluoride has been accidentally taken in doses of five, six and nine grams without causing death although severe sickness resulted.[2] In the case of arsenious oxide much less than a gram is said to cause death.

Preliminary tests of attractiveness of various materials were made during the first summer. Ground meat was one of the most eagerly devoured of all substances. The use of this material however, is impractical on account of cost and the difficulty of mixing with poison and scattering. Sweetened wheat bran seemed attractive enough for practical purposes but an effort was made to improve upon it if possible by the addition of other substances. One of the first substances tried was amyl acetate which has been found to be a valuable addition to poison bait for grasshoppers.[3] This was added to bran sweetened with molasses, as recommended for grasshoppers, enough to give a pronounced odor of banana, and eight small piles deposited at regular intervals along the top of a board fence, alternating with piles of the same material but without the amyl acetate. After a time the earwigs feeding at each pile were counted, with the following results:

With amyl acetate 6, 15, 8, 10, 10, 9, 10, 6.

Without amyl acetate 3, 16, 6, 6, 6, 8, 10, 25.

Totals with amyl acetate, 74; without, 80.

In another similar test with eleven piles of each bait, the results were as follows:

With amyl acetate 10, 3, 2, 7, 5, 6, 10, 12, 6, 1, 3.

Without amyl acetate 9, 4, 6, 5, 6, 10, 10, 8, 6, 3, 6.

Totals: with amyl acetate, 65; without, 73.

[2] Baldwin, H. B. The Toxic Action of Sodium Fluoride. Jour. Amer. Chem. Soc. 21, pp. 517–521, 1899.

[3] Parker, J. R., and Seamans, H. L. Jour. Ec. Ent. 14 pp. 138–141, 1921.

These results indicate that amyl acetate adds nothing to the attractiveness of poison bait for earwigs.

Another series of tests was made using wheat bran sweetened with molasses, and the same flavored with anise oil, meat extract and glycerin. These were placed out in sets of four piles each, one of each mixture. There were four sets containing all four mixtures and the number of earwigs feeding were counted at two different times during the night with the following totals:

Plain	18	Meat Extract	19
Glycerin	64	Anise oil	18

Four other sets containing only plain bran and molasses and the same flavored with meat extract gave the following totals.

Plain 17. Meat extract 29.

In these tests glycerin seemed to be the only material with very marked value, but further tests were needed to confirm this. At least it did not act as a repellant and its moisture retaining properties were quite valuable. On the following evening, the other mixtures were quite dry and hard while that containing glycerin was still moist enough to attract a good many earwigs.

During the second season's work further tests of mixtures containing molasses and glycerin were made. In the first series, water and molasses were mixed in proportions of two to one, and glycerin added to this to make 50%, 25%, and 12.5% solutions. Wheat bran was saturated with each mixture, and the 25% of glycerin mixture was also used with rice bran and oat hulls. These five mixtures were placed in small piles nearly a foot apart along a narrow board which was placed on the ground in a spot where earwigs were plentiful. Three counts of the earwigs feeding were made at about ten minute intervals. The insects were then driven off and the board was reversed and three other counts taken. The results were as follows, in the order of position on the board:

	1 Wheat bran Gly. 50% Mol. 16.6%	2 Wheat bran Gly. 25% Mol. 25%	3 Wheat Br. Gly. 12.5% Mol. 29.16	4 Rice bran Gly. 25% Mol. 25%	5 Oat hulls Gly. 25% Mol. 25%
3 counts....	22	22	21	42	70
Reversed order 3 counts....	100	84	86	64	102
Total.....	122	106	107	106	172

Knowing that two piles at either end of the board would attract more

earwigs by virtue of position, the piles were then rearranged and another series of counts taken in the following order:

	3 Wheat bran Gly. 12.5%	2 Wheat bran Gly. 25%	1 Wheat bran Gly. 50%	5 Oat hulls Gly. 25%	4 Rice bran Gly. 25%
1st position.	32	27	17	30	50
Reversed...	53	42	44	60	64
Total.....	85	69	61	90	114

From these results it would appear that the three mixtures of glycerin and molasses are approximately equal in attractiveness, while the mixtures containing rice, bran and oat hulls were slightly more attractive, the latter giving the highest total count.

Rice bran and oat hulls are not of such a nature that they can be scattered easily and this mechanical objection would exclude them for use on the ground, but as a bait to be applied to objects, for late summer work after the earwigs are old enough to climb about, they would be superior to wheat bran.

In another series of tests the attractiveness of glycerin alone was compared to molasses alone, and to bran wet with water only. Five piles of bran were placed on a board as follows and counts made in two locations:

	Water	Mol. 25%	Mol. 50%	Gly. 50%	Water
Totals.....	60	81	104	47	56

From these figures it is evident that glycerin alone adds little if anything to the attractiveness of the mixture. The advantage of position would probably account for the fact that more earwigs visited the bran piles wet with water alone.

These materials were left in the last location until the following night when they were examined. The bran which had been wet with water alone was thoroughly dry, those with molasses were very slightly moist, while that containing glycerin was distinctly moist. Two counts of earwigs at different hours gave the following:

Water	Molasses 25%	Molasses 50%	Glycerin 50%	Water
4	13	37	51	1

At any one time more earwigs were feeding at the glycerin pile than at any time on the previous evening, due no doubt to the lessened attractiveness of the other mixtures.

Another comparison was made using mixtures containing molasses and the poison ingredient, sodium fluoride, with glycerin and without. The first lot of bran was wet with a mixture containing equal volumes of sodium fluoride solution (1 ounce in 4 ounces of water), glycerin and molasses. In the second lot the glycerin was replaced with water leaving identical amounts of poison and molasses. This experiment was primarily planned to see if glycerin affected the poisonous properties; but the two lots were exposed to get additional evidence on the attractiveness. The results on the first night were: first mixture, 38; second mixture, 37. On the second night: first mixture, 16; second mixture, 3.

POISON USED WITH EACH 4 lbs. BRAN	TOTAL EARWIGS IN LOT	TOTAL DEAD EACH MORNING AFTER EVENING OF POISONING										
		1	2	3	4	5	6	7	8	9	10	20
NaF 1 oz.	85		1	23	66	77		83	83	83	83	
NaF 2 oz.	43	1	5	28	36	42	42	42	42	43		
NaF 4 oz.	24		7	19	23	24						
NaF 8 oz.	104	14	56	101	104							
CaF_2 1 oz.	14				1	1	1	1	1	1	1	7
CaF_2 2 oz.	120							2	2	2	2	85
CaF_2 4 oz.	59							1	1	1	1	43
CaF_2 8 oz.	81		8	41	56	69	73	74	75	75	75	77
As_2O_3 1 oz.	41	1	1	1	3	4		26	37		40	
As_2O_3 2 oz.	41		1	9	24		38	41				
As_2O_3 4 oz.	74		4	34	66		74					
Na_3AsO_4 2 oz.	9			4			6	9				
Na_3AsO_4 4 oz.	33	2	8	25	28		31	32	33			
Na_3AsO_4 8 oz.	111	7	16	65	98		111					

Table I. Showing toxicity of various amounts of sodium fluoride, calcium fluoride, arsenious oxide, and sodium arsenate for the European earwig.

This, and the previous experiment both show that glycerin has considerable value as an ingredient to extend the attractiveness of a poison bait over a longer period of time.

The killing effect of the two above mixtures was approximately equal. When mixed with bran they gave a poison bait containing about 8 ounces of poison to 4 pounds of bran, equal to the strongest mixture shown in Table I. The mixture containing glycerin gave 45 dead and 1 alive on the second morning, while the mixture without glycerin gave

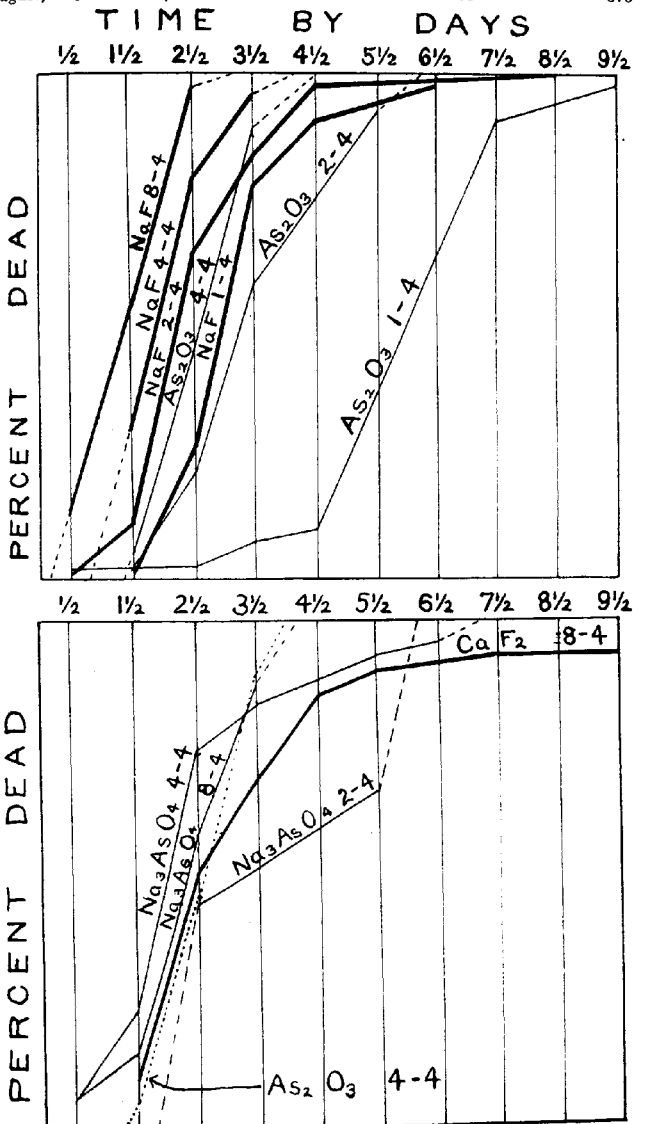

Chart I. Curves showing toxicity of sodium fluoride, arsenious oxide, sodium arsenate and calcium fluoride, for European earwig.

45 dead and 4 alive. On the third morning all were dead. From this we can judge that the glycerin does not interfere with the poisonous properties of sodium fluoride.

EMERGENCE RECORDS OF THE PEACH TREE BORER, *AEGERIA EXITIOSA* (SAY), IN PENNSYLVANIA

By Eugene M. Craighead, *Bureau of Plant Industry, Harrisburg, Pa.*

Successful control of the peach tree borer by the use of Paradichlorobenzene (commonly called PDB) is dependent on an accurate knowledge of its habits and especially on the determination of methods for securing the maximum kill. In order to secure accurate data on adult emergence, experiments were conducted for two years in Franklin County, Pa., at the Chambersburg Laboratory of this Bureau under the supervision of Prof. J. G. Sanders, Director.

In 1921 from May 15th to August 10th, nearly 700 cocoons were collected, of which number about 500 contained larvae. From the 500 pupae, 174 males and 184 females emerged, making a total of 358 adults. About 4% of the pupae were parasitized. In May, 1922, wire cages

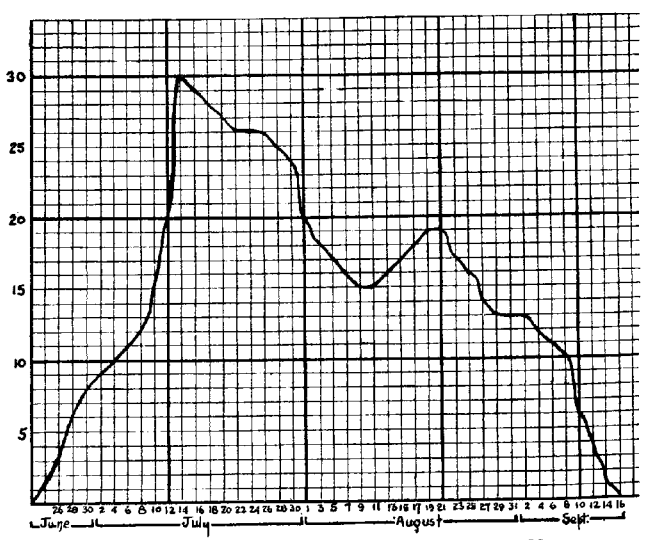

Fig. 4—Emergence of peach tree borer adults for 1922.

Plate 5

Base of tree caged to obtain emergence records of peach tree borers

were placed around 52 trees and records were made every two or three days from June 1st to October 5th during the emergence season. (Pl.5) From the 52 trees a total of 657 adults were recorded, the first adult emerging June 26th, while the first record of emergence in 1921 was June 16th. However, that year the season was from two to three weeks early.

Cages for obtaining emergence records were made of fine fly wire thirty-six to forty inches wide. (Pl.5). They were made by cutting along the circumferences of two radii: One, that of the tree fourteen inches from ground and the other that of tree at the ground line plus six inches. (A little practice makes measurements unnecessary.) The edges were fastened by means of brass paper clips. The bottom was buried two or three inches and the top about the tree made tight by packing cotton between the cage and the tree.

Adults were killed by stabbing them with a long hat pin, a method which saved hours of labor in opening up cages every time adults emerged. No records were made unless adults were alive in the cage at the time of examination. Ants and ground beetles soon devoured the dead bodies. The total number emerging, as before given, was 657, making an average of 12.6 per tree.

CONTROL: Many parasites of the species, *Microbracon sanninoides* Gahan, were reared and identified by Mr. S. A. Rohwer. Two more parasites have been turned over to Mr. Rohwer and one of these is reported to be a new species; the other is as yet undetermined.

TREATMENT WITH PDB: With Sept. 15th as the date of the last emergence of the adults in vicinity of Chambersburg, Pa., it was deemed advisable not to start treatment with paradichlorobenzene before this time. Trees three years of age have been treated without injury, using one-half ounce per tree, for a period of two weeks and then promptly removing the mounds. Results of control with trees of this age and older gave a control ranging from 90 to 99 percent.

NOTES ON THE INSECT PESTS OF UTAH[1]

BY IRA M. HAWLEY, *Logan, Utah*

Many parts of Utah, because of the mountain ranges and the dry and uncultivated lands that separate the tilled portions of the state, are protected from the gradual spread of injurious insects. For this reason many pests of long standing in most parts of the country are still absent or but recently introduced into the state. The Colorado potato beetle

[1]Contribution from the Entomological Department, Utah Agricultural College.

may be mentioned as an example of this. Tho it has spread from its native home on the upper Missouri River to most parts of the United States, it has not reached the state of Utah, and potatoes may be grown as a rule without treatment for insect pests.

Many common fruit pests, such as the apple maggot, bud moth, red bugs, case bearers, pear psylla, and pear midge, are not found in Utah. The fruit-tree leaf-roller has been in the state at least fifteen years but is not as yet general in its distribution. The same may be said of the canker-worm and pear-leaf blister mite which are of more recent importation. The San Jose scale, tho of common occurrence in some localities, has never been found in Cache County, an isolated valley in the northern part of the state. It may be seen, therefore, that spraying practice is often much simplified. In spraying apples, the "pink" spray is always omitted and in some places a dormant spray is not considered necessary.

In a state where the raising of sugar-beets is as extensive as it is in Utah, the insect pests of this crop, as would be expected, are abundant and must always be considered important. The sugar-beet web-worms (*Loxostege sticticalis* L.) were so numerous in 1921 that unsprayed beets were often totally destroyed. Four hundred caterpillars were present on some plants, and as they approached maturity they began migrating by the thousands. This abundance of the worms gave an excellent opportunity for the increase of parasites. From a lot of eleven hundred larvae in winter cocoons that were collected in the fields during September, 176 moths of the web-worms and 396 parasites were reared. It is believed that the presence of these parasites in such large numbers is largely responsible for the small number of caterpillars present in 1922, for in spite of favorable hibernating conditions very little damage occurred during the past summer.

The sugar-beet root-louse (*Pemphigus betae* Doane) was very common in 1921 as was also the beet-leaf miner (*Pegomyia hyoscyami* Panzer). The first brood of this last mentioned pest has been abundant enough to destroy many of the early leaves during the past two years, but the second brood has been so small that there has been no loss later in the season. The sugar-beet root-maggot (*Tetanops aldrichi* Hendel), which has been described in a previous number of THE JOURNAL OF ECONOMIC ENTOMOLOGY[2] and which was responsible for considerable loss in 1921, caused almost no damage in 1922, due apparently to the hot and dry condition of the soil when the eggs of the insect were deposited in it.

[2]Jour. Econ. Entom., v. 15, p. 388.

There were so many of these eggs that shriveled that only a very small percentage hatched. The sugar-beet crown-borer (*Hulstea undulatella* Clemens) was so abundant that 30 to 50 per cent of the plants were destroyed in some fields. This insect was described by Titus[3] in 1905 and its presence in Utah has been known for at least eight years. The larva works on the crown of the beets and either cuts off the top or injures it so that it does not develop. When one tries to pull up a badly infested plant, it breaks off at the crown where the caterpillar in its silken cocoon may be found feeding.

The beet leaf-hopper (*Eutettix tenellus* Baker) has been more injurious during the past summer than for several years. It was especially bad in Sevier and Millard Counties, but was found locally in other beet-growing sections. This may be a forerunner of a still more severe infestation next year.

The alfalfa weevil was not an important pest during the summer of 1922. The writer does not know of a case where it was considered sufficiently serious for control measures to be applied. The alfalfa caterpillar (*Eurymus eurytheme* Boisd.) as a pest of alfalfa was of negligible importance, but in Weber County it caused considerable loss by feeding on the skins of watermelons. Tho this did not greatly impair the edibility of the melon, it did seriously reduce its market value. The clover-seed chalcid (*Eruchophagus funebris* Howard) has been very destructive to alfalfa that was being grown for seed, especially in the Uintah Basin.

The outstanding features of the year have been a later-summer infestation of corn ear-worm in both field corn and sweet corn that in some cases affected 100 per cent of the ears and the destruction of newly planted apple orchards in Utah County by a tree hopper (*Stictocephala festina* Say), especially when the orchard was set out in or near an alfalfa field or patch of sweet clover. There has also been a marked increase in the number of grasshoppers in many parts of the state, and since in many places poisoning campaigns have not been undertaken on a general scale, considerable loss has been sustained. The so-called "black" or "Mormon" cricket (*Anabrus simplex* Hald.) has also been on the increase during the past two years and is creating much interest in view of the immense losses that it caused to the early settlers of the state. It would not be surprising if the insect were still more abundant next year.

[3]U. S. D. A. Bur. Ent. Bul. 54. (n. s.)

NOTES ON THE LENGTH OF TIME AEDES CALOPUS (STEGOMYIA) LARVAE SHOULD BE EXPOSED TO A FILM OF KEROSENE

By M. E. Connor, M.D. and W. M. Monroe, M.D.
International Health Board

Abstract

A ten-minute exposure to a film of kerosene is sufficient to cause the death of all but a very small percentage of *Aedes calopus* larvae, and for this reason washerwomen may after ten minutes skim off the film of kerosene from their water containers and use any portion of the water underneath.

It would also seem that the petroleum acts not only to exclude the larvae's supply of oxygen but also as a toxin, and in this capacity is responsible for most of the larval death rate, as its toxic action is more rapid than its mechanical effect.

The question as to the length of time that the *Aedes calopus* larvae live after the oxygen of the air has been denied them came up for study in the field work of the staff engaged in the control of yellow fever in Tampico, Mexico.

Throughout the gulf coast region of Mexico the tap and well water are so heavily charged with calcium salts that the washerwomen find it necessary to mix wood ashes with the raw water in order to counteract its hard quality. The softened water, which is called *lejia*, is alkaline in reaction and appears to be especially attractive to the *Aedes calopus*. Receptacles in which *lejia* is stored can be made proof against mosquitoes only by covering the surface of the water with refined petroleum. These containers cannot, like the tanks, be supplied with perfectly fitting covers, nor can they be stocked with fish like the barrels containing fresh water, for fish will not live in *lejia*. Moreover, the container cannot be emptied and left inverted, since *lejia* is important as a means of livlihood to a large number of people. It was the practice of our inspectors, therefore, to place a good film of oil on the surface of the *lejia* in which breeding was known to occur, and this measure appeared to be successful in killing in a reasonable time the greater number of larvae in the containers.

Frequently, however, in the course of re-inspection of mosquito control work, a single larva would be found in many of the *lejia* containers that had been treated to a coating of kerosene. The suspicion arose that either the inspectors had not properly oiled the containers or that the larvae were developing resistance to the oil. When one district inspector reported that he had detected a woman skimming from a *lejia* container a film of oil placed there only a few minutes before, the mystery of the single larva was partly explained, and there was opened up the interesting question as to the minimum time that a good film of oil must remain on *lejia* to be effective.

The time required to kill larvae through depriving them of oxygen

from the air could easily be determined. This was done in our laboratory by filling a bottle completely full of water containing larvae, then placing the thumb over the top to prevent the admission of air, and inverting the bottle in a larger jar of water much as is done in fashioning a home-made barometer. The larvae, thus prevented from obtaining any oxygen whatsoever except what they might get from the water itself, died in from three and one-half to thirty-six hours. A good film of kerosene, however, had been found to kill all but a very small per cent of larvae in from 60 to 100 minutes, though an occasional small larva was known to have lived under an oil film for as long as three days.

Recently many experimenters have come to believe that kerosene acts upon larvae not only mechanically by excluding the supply of free oxygen, but also as a poison showing a selective action on the epithelium lining the inside of the air siphon. If this is true, only a short exposure of the larvae to the coating of oil should be necessary for their elimination and the inspectors may safely permit the washerwomen to remove the oil from *lejia* in much less time than one hour.

In order to determine the length of time larvae survive under an oil film, a series of four experiments was conducted. In the first of these, six wide-mouthed bottles were set up in the laboratory and nearly filled with water. Twenty larvae were placed in each bottle, and a thick layer of kerosene was applied to the surface of the water. After periods varying from one-fourth to one and one-half hours, the kerosene was decanted and completely removed by adding water until the bottle had overflowed for some minutes. The kerosene in two of the bottles was allowed to remain, thus serving as a check to determine the length of time required for the film of kerosene to kill the larvae. Results of this experiment are shown in Table 1.

It was seen that larvae could be destroyed by a much shorter exposure to the action of the oil than was employed in the foregoing experiment, for in all the bottles from which the oil was removed the larvae died nearly as soon as those in the check bottles. Only one exception occurred: in bottle 5, one larva recovered entirely and did not seem to be injured at all by an hour's exposure to the oil. In view of the fact that the other fifty-nine larvae were destroyed by the same or shorter contact with the oil, it may be assumed that either this larva had remained at the bottom of the bottle, subsisting on stored up oxygen or extracting the needed oxygen from the water by means of its anal gills, or else had for some reason remained refractory to the action of the poison. It would seem that the presence of a single larva in *lejia* or in

other deposits that have been treated with oil may be similarly explained. We have known of one case in which there were even second-stage Stegomyia larvae in a tambour of water on which a film of oil had been placed by an agent twenty-four hours before.

In a second experiment five bottles were set up and supplied with water, larvae, and kerosene, which was removed after periods of five, ten, fifteen, or thirty minutes. In the bottles from which the oil was removed after five minutes a large proportion of larvae survived, but in all the other bottles the larvae were killed. It may be assumed therefore that the time of exposure necessary to kill all but a very small number of larvae lies between five and ten minutes. (See Table 2.)

In a third test the larvae were exposed to the oil for one, two, three, and four minutes respectively, but it was found that too high a percentage of larvae survived these shorter contacts. (See Table 3.)

The larvae destroyed in these experiments were killed either by the toxic action of petroleum or by the exclusion of their supply of oxygen. In the latter case death may have been due to long exposure to the kerosene or, where the larvae were subjected for but a short time to the action of the kerosene, death may have resulted from the occlusion of the breathing syphon with a globule of oil. It is reasonable to suppose, however, that the larvae could free themselves of an impeding globule of kerosene by the use of their mouth brushes. Certainly the exclusion of their supply of oxygen for five or ten minutes would not kill them, for it has been shown that *Aedes calopus* larvae will live for from three and one-half to thirty-six hours when deprived of oxygen by mechanical means only. The death, then, of those larvae exposed but for a few minutes to the film of kerosene can be accounted for only on the supposition that the kerosene acted as a selective toxin.

Not all oils show this toxic property, as was discovered by a further experiment. In this test we used large bottles nearly full of water, adding only ten larvae to each bottle to avoid the complication of suffocation through overcrowding. In the first three bottles we placed a thick layer of gasoline; in the next three, different grades of kerosene; in the next three salad oil, and from the last three we excluded air by mechanical means. At the end of two hours all the larvae were dead under the gasoline and kerosene, but under the salad oil twenty-four were still living, while twenty-eight were living in the bottles from which the air had been excluded by mechanical measures. At the end of seven hours there were eight larvae living under the salad oil and nine

in the bottles from which air had been excluded mechanically. Salad oil must, therefore, lack the toxic properties of petroleum.

There is a vast difference in the behavior of larvae whose air supply has been excluded by mechanical means and that of the larvae which have been deprived of air by a film of kerosene. The former seek to retain their position at the surface of the water, thrusting their syphons again and again against the cover glass and continuing a rapid movement up and down until they die from utter exhaustion. Under a film of kerosene, on the other hand, the larvae will either almost immediately leave the surface, dropping down to the bottom of the container where they remain prone for long periods of inactivity followed by spasmodic movements of their posterior abdominal segments, or else they will float on the surface of the water wriggling little if at all.

TABLE I.—LENGTH OF LIFE OF AEDES CALOPUS LARVAE IN WATER COVERED WITH PETROLEUM FILM. PERIODS OF EXPOSURE ¼ TO 1½ HOURS.
(FIGURES INDICATE THE NUMBER OF SURVIVING LARVAE)

Time	Pet. Not Removed		Petroleum Removed After			
	Bottle 1	Bottle 2	¼ hour Bottle 3	½ hour Bottle 4	1 hour Bottle 5	1½ hour Bottle 6
(9.40) A. M.	20	20	20	20	20	20
9.45	15	14	15	14	13	10
9.50	12	11	13	12	11	8
10.00	7	8	13	10	7	5
10.10	4	5	5	6	3	5
10.25	3	3	4	3	3	2
10.40	1	2	3	3	2	2
10.55		2	2	3	1	1
11.35		1		1	1	
12.15 P. M.		1		1	1	
2.00 P. M.					1	

TABLE II.—LENGTH OF LIFE OF AEDES CALOPUS LARVAE IN WATER COVERED WITH PETROLEUM FILM. PERIODS OF EXPOSURE 5 TO 30 MINUTES

Time	Petroleum Removed After				
	5 min. Bottle 1	10 min. Bottle 2	15 min. Bottle 3	20 min. Bottle 4	30 min. Bottle 5
10.25 A. M.	20	20	20	20	20
11.00	18	12	11	9	13
11.30	18	8	9	7	11
12.00	18	3	5	2	7
12.30 P. M.	18		3		3
1.00	18		2		3
1.30	17		1		2
2.00	12		1		1
2.30	12		1		1
3.00	8		1		1
4.00 P. M.	7				1
7.30 A. M.	5				

TABLE III.—LENGTH OF LIFE OF AEDES CALOPUS LARVAE IN WATER COVERED WITH PETROLEUM. PERIODS OF EXPOSURE 1 TO 5 MINUTES

Time	Petroleum Removed After				
	1 min. Bottle 1	2 min. Bottle 2	3 min. Bottle 3	4 min. Bottle 4	5 min. Bottle 5
10.00 A. M.	20	20	20	20	20
10.25	20	16	13	10	12
11.00	18	10	8	6	8
11.30	16	8	6	4	4
12.00	11	5	5	3	2
12.30 P. M.	11	5	4	3	2
1.00	11	4	3	3	2
1.30	10	3	1	3	2
2.00	10	3	1	3	1
3.00	7	3	1	3	1
4.00	7	3	1	3	1
5.00	7	3	1	3	1
8.00 A. M.	7	3	1	3	1

TABLE 4.—LENGTH OF LIFE OF AEDES CALOPUS LARVAE IN WATER FROM WHICH OXYGEN WAS EXCLUDED BY VARIOUS METHODS

Time	Gasoline Film			Kerosene Film			Salad Oil Film			Mechanical Measures*		
	Bottle 1	Bottle 2	Bottle 3	Bottle 4	Bottle 5	Bottle 6	Bottle 7	Bottle 8	Bottle 9	Bottle 10	Bottle 11	Bottle 12
9.00 A. M.	10	10	10	10	10	10	10	10	10	10	10	10
9.30	5	7	6	4	6	5	10	10	10	10	10	10
10.00	3	4	2	2	2	3	10	10	10	10	10	10
10.30	1	2	2	1	1	2	9	10	8	10	10	10
11.00	—	—	—	—	—	—	8	9	7	10	10	8
11.30							8	9	7	9	8	5
12.00							8	9	6	5	6	
12.30 P. M.							8	9	6	5	6	
1.00							8	9	6	5	6	
1.30							8	9	6	5	5	
2.00							8	6	6	5	4	
2.30							8	5	5	5	4	
3.00							6	5	5	5	4	
4.00							6	1	1	5	4	
5.00							1	—	1	5	4	
6.00							—	—	1	5	4	
8.00							—	—	—	3	3	
7.30 A. M.										1	2	
9.00										1	2	
12.00										1	2	

*Oxygen excluded by inverting bottle in larger container.

PARASITISM OF THE EUROPEAN PINE SAWFLY, *DIPRION (LOPHYRUS) SIMILE* HARTIG, HYMENOPTERA, TENTHREDINIDAE, IN PENNSYLVANIA[1]

By E. A. Hartley

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Heavy parasitism of the European Pine Sawfly in America has apparently rendered this potentially injurious immigrant of little importance as a pest of our pines. Evidence of a prompt attack of this imported species by our native parasites was first reported by Dr. Britton[2] shortly after the discovery of the sawfly in America, when he reared the following native species: *Pachyneuron (Dibrachys) nigrocyaneus* Nort. parasitizing 31%, and one specimen each of *Hemiteles utilis*[5] Nort., an Ichneumonid, a species of *Cerambycobius*, and a Tachina fly, *Exorista petiolata* Coq. In 1917 Dr. Britton[3] after a large collection of over-winter cocoons, reported 37% parasitism involving the following parasites: *Pachyneuron (Dibrachys) nigrocyaneus* Nort., *Monodontomerus dentipes* Boheman *Dibrachoides verditer* Nort., *(Pteromalus), Delomerista* n. sp., *Cerambycobius* sp. (probably new), *Eurytoma* sp., *Hemiteles utilis* Nort. and the Tachina, *Exorista petiolata* coq. Only the first three were in effective numbers. All of these parasites are natives except *Monodontomerus dentipes* which is a European species previously found in the United States. In the spring of 1917, Weiss[4] reported a parasitism of 90% by *Mondontomerus dentipes* for the European Pine Sawfly in New Jersey.

Diprion simile was first noticed in the Philadelphia District in 1918 when only a few larvae were collected on a small row of *Pinus cembra*. Scattered larvae were noticed on *Pinus strobus* and *P. cembra* in several parts of a large nursery during the three years following, but nowhere had they increased to destructive numbers, except perhaps, in about a half acre block of *Pinus cembra* in the summer of 1921 where the infestation was about evenly distributed thruout the block and heavy enough to cause noticeable defoliation. Larvae were conspicuous on practically every tree.

In early June of the following season (1922) the block of pines was again examined and a marked decrease in the infestation was at once noticed; for in spite of the presence of many over-winter cocoons on

[1]Contribution from the Bureau of Plant Industry, Harrisburg, Pa., and the New York State College of Forestry, Syracuse, N. Y.

[2]Fifteenth Connecticut Report. [3]Seventeenth Connecticut Report.

[4]Jour. Econ. Ent., Vol. X, No. 1, 1917.

[5]Now H. Tenellus says; Cushman & Gahan, Proc. Ent. Soc. Wash., 23:163, Oct. 1921.

the twigs, only a few larvae were found to a tree. A number of these over-winter cocoons were collected and a count disclosed 238 out of 321 containing exit holes of parasites. At the same time several adult parasites were noticed ovipositing in newly spun cocoons and other adults of the same species were swept from the foliage. These were later determined by Mr. Gahan of the U. S. National Museum as *Monodontomerus dentipes* Boheman. Ninety-four freshly spun cocoons were taken June 16th which yielded 39 adult sawflies by July 2nd, and 118 parasites from 15 cocoons. By July 14th, 59 more parasites had emerged from 12 cocoons. All of these parasites were *Monodontomerus dentipes* except 6 specimens of *Eurytoma* sp. and 2 *Cryptus lophyri* Nort., determined by Mr. Gahan. The 28 remaining cocoons were kept in storage at room temperature (70 degrees F.) until Jan. 5th 1923, when they were all opened. Four of the cocoons contained adults, mostly dead, of *Monodontomerus dentipes*, 16 others carried from 1 to 15 living parasite larvae, and 8 bore dead and shriveled remains of sawflies.

From the above figures, this lot of 94 cocoons of the first spring brood of *Diprion simile* gave a parasitism of 53%, almost entirely *Monodontomerus dentipes*.

Another lot of 123 cocoons collected July 17, 1922, gave one *Diprion simile* and a number of *Monodontomerus dentipes* by August 5th. No more sawflies or parasites emerged that season. The following January 5, 1923, the remaining cocoons were opened and 86% were found to contain parasites in some stage, averaging 9 parasites to a cocoon. Twelve cocoons contained live pupae and three were full of dead adults of *M. dentipes*. The great majority, however, bore from one to 20 larvae all very much alike. Two of the cocoons yielded the puparium of a fly, probably a Tachina. In one the fly had emerged inside the cocoon, but was apparently unable to reach the outside thru the tough walls of the cocoon. This condition has been previously noted by Dr. Britton.[5]

No evidence of secondary parasitism was noted in these dissections, unless, perhaps, in the presence of a few dead larvae, the cause of which was impossible to ascertain.

Several cocoons contained the withered remains of the sawfly covered with a fungus mycelium, often with living larvae of the parasites, showing their ability to live with the fungus.

In one or two cases, adult *D. simile* were found in their cocoons with

[5]Seventeenth Connecticut Report.

the living larvae of parasites, showing successful attack by the parasites in the later stages of the host development. This is not surprising when it is recalled that *M. dentipes* was observed in the field ovipositing in the cocoons of *D. simile* on the pine twigs.

Monodontomerus dentipes Boh. has been recorded from Holland by Ritzema[6] as a parasite from the cocoons of *Diprion pini*, a species often confused with *D. simile* in Europe, and it is highly probable that it was introduced into the United States in cocoons of *D. simile* on imported pines. It also occurs in Europe as a parasite of Lepidoptera, *Dendrolimus* (*Bombyx*) *pini* in Austria, and from the cocoons of *Zygaena occitanica* Vill. in France. A similar species, *Monodontomerus aerus* Walk. was early introduced against the gipsy and brown-tail moths in New England where it has become a widespread pupal parasite. Unfortunately it is also a secondary about as much as it is a primary, so its usefulness is in question. Whether *M. dentipes* will attack our native Lepidoptera as it does in Europe, or become a dangerous secondary in Lepidoptera here as in case of its near relative, *M. aereus*, remains to be seen. In spite of these evident possibilities, the above data show for the present at least, that it is one of the most effective natural checks to the European Pine Sawfly in New Jersey and Pennsylvania.

The other two species reared, *Eurytoma* sp. and *Cryptus lophyri* Nort. were not found in sufficient numbers to be considered of much importance in suppressing the European Pine Sawfly in America. However, it may be interesting to note that this is the first record of *Cryptus lophyri* Nort. in *Diprion simile* in the United States.

THE EFFECT OF CS_2 ON THE GERMINATION OF SEEDS

By C. J. Willard, *Farm Crops Department, Ohio State University*

Abstract

1. It would seem that in practice no aeration of storage places is necessary after fumigation with CS_2 whatever dose may be used, unless they are airtight. Bins and similar storage places for seeds almost never are airtight and before any of the longer periods reached by these experiments had elapsed the CS_2 would have diffused out of the bin.

2. It required very large doses of bisulphide for a considerable period of time to have any marked effect on the germination of the seeds used in this experiment. The injury slowly becomes greater as the time increases and as the dose increases, but is not directly proportional to either.

3. Seeds vary tremendously in their resistance to CS_2 injury.

4. Different varieties of the same species are very differently affected, perhaps due to the pigment in the seedcoat. (Note garden beans and cowpeas.)

5. The first injurious effect of CS_2 on seeds is a retardation of germination.

[6]Report of the Institute of Phytopathology at Wageningen 1915.

6. It seems that liquid CS_2 poured on most seeds in fumigation will not injure them sufficiently to be of practical importance.

In the directions for killing insects with CS_2 a warning is usually included that the bin should be aired out within a short time or the germination of the seeds is likely to be injured. In the writer's experience in preserving hundreds of small lots of seeds free from insect attack it was often inconvenient to do this. This suggested the problem of testing the resistance of our common seeds to injury by bisulphide in order to discover within what limits the treatment could be varied without injuring the seeds.

E. A. de Ong reported in this JOURNAL (Vol. 12, pp. 343–345) that most common seeds would withstand treatment at the rate of 30 pounds per thousand cubic feet for 42 hours or at 40 pounds per thousand cubic feet for 18 hours. Some ten other references on this subject were found in the literature but none of them carried the treatment very far either as to excessive doses or excessive length of time.

Methods. The seeds were treated in two-quart Mason jars with the usual rubber ring seals. When the seeds were exposed a week or more the rubber ring was coated with paraffin to reduce the solvent action of the bisulphide on the rubber and then the seal coated with paraffin after the jars were closed. The bisulphide was dropped into the jars from a burette on sufficient filter paper so that the liquid bisulphide did not touch the seeds. Two-tenths cc. of bisulphide to the two-quart jar is equivalent to one pound to 118 cubic feet and was considered the normal dose. For the treatment with a saturated atmosphere of CS_2 a four ounce bottle partially filled with bisulphide was carefully lowered into the jar before sealing it. The same amount of grain (one pint) was placed in each jar. The work was carried out at a constant temperature of 80° F.

TABLE 1. TESTS OF SEEDS TREATED WITH 1.6 CC. PER JAR (68 POUNDS PER 1000 CUBIC FEET) FOR 21 DAYS

Seed Used	Total Germination Check	Treated	Seed Used	Total Germination Check	Treated
Red Clover	78	73	Dent Corn (4 weeks)	100	100
Alsike Clover	80	81	Barley, Oderbrucker	95	81
White Sweet Clover	48	43	Barley, White Hulless	98	32
Hairy Vetch	71	67	Sweet Corn	94	76
Garden pea, Marrowfat	100	94	Oats, Miami	88	58
Field peas, Canada	94	84	Wheat, Portage	97	23
Soybeans, Manchu	96	66	Rye	72	49
Cowpeas, Black	84	38	Sorghum, Early Amber	95	31
Cowpeas, Blackeye	96	0	Buckwheat	94	0
Navy beans	98	0	Timothy	97	67
Garden Beans, White Kidney	94	0	Kentucky Bluegrass	83	64
Garden Beans, Black Wax	96	84	Redtop	91	88

Data. In order to discover which seeds were most susceptible to carbon bisulphide treatment a number of kinds of seed were treated with 1.6 cc. per jar (68 pounds per thousand cubic feet) for twenty-one days. The results are given in Table 1.

As a result of this treatment there is every gradation from no effect whatever in the case of corn and alsike clover to a total loss of germination in the case of buckwheat, black-eyed peas and navy beans.

As a result of this preliminary test systematic tests varying the length and severity of the exposure were started with corn, wheat, buckwheat and navy beans. The results are given in the following tables:

TABLE 2. CORN TREATED WITH CS_2 VAPOR

Dose	Number of days exposure					
	7	14	21	28	42	56
.6 cc.	100	98	93	100	100	100
1.6 cc.		99		100		100

Average check germination 100.

TABLE 3. WHEAT TREATED WITH CS_2 VAPOR

Dose	Number of days exposure						
	2	4	8	16	24	32	64
.2 cc.	98	100	99	97	96	98	96
.4 cc.	98	99	98	99	90	99	98
.8 cc.	97	98	99	100	92	99	98
1.6 cc.	99	97	96	99	76	95	92
3.2 cc.	98	93	87	93	62	95	31
Saturated atm.	86	85	73	73	20	29	0

Average check germination 99.

TABLE 4. BUCKWHEAT TREATED WITH CS_2 VAPOR

Dose	Number of days exposure				
	2	4	8	16	24
.2 cc.	98	99	99	95	94
.4 cc.	98	96	97	99	96
.8 cc.	93	99	97	96	96
1.6 cc.	95	100	95	99	97
3.2 cc.	95	94	100	94	93
Saturated atm.	96	95	91	87	71

Average check germination 99.

TABLE 5. NAVY BEANS TREATED WITH CS_2 VAPOR

Dose	Number of days exposure				
	2	4	8	16	24
.2 cc.	84	86	90	76	70
.4 cc.	86	78	86	76	66
.8 cc.	88	78	86	74	64
1.6 cc.	83	68	76	68	32
3.2 cc.	82	70	56	56	1
Saturated atm.	67	42	30	6	0

Average check germination 85.

Dent corn was not affected by any treatment used. The other seeds were more or less injured, the injury increasing with the length of exposure and the size of dose, though not in any definite ratio.

However, the seeds were more injured by the bisulphide than appears in these tables. The first effect of the treatment was to delay germination one or more days later than the check. The delay was due to a definite injury to the seeds as is shown by the fact that a treated sample showed the same delayed germination a year after the treatment. A few examples from the large amount of data secured are given in Table 6.

TABLE 6. DATA TO SHOW RETARDATION

Seed and Treatment	Number germinated 2 days after test was started	3	4	5	6	7	8	Total
Timothy, check		60	30		7			97
Timothy, 1.6 cc. for 21 days		0	21		66			87
Buckwheat, check		91	2					93
Buckwheat, 24 days, 3.2 cc		66	25	2				93
Buckwheat, 24 days, Saturated atm		14	20	0	8	16	13	71
Wheat, check	77	22						99
Wheat, 16 days, .2 cc	78	19						97
Wheat, 16 days, .4 cc	46	53						99
Wheat, 16 days, .8 cc	56	44						100
Wheat, 16 days, 1.6 cc	21	74		4				99
Wheat, 16 days, 3.2 cc	19	84		7				93
Wheat, 16 days, Saturated atm	4	34		32		3		73

In the wheat series the sample treated with .8 cc. and 1.6 cc. both made a total germination equal to the check yet they were definitely injured by the treatment as shown by the delayed germination. In the timothy series on the third day it appeared that the treated seed was entirely killed. Finally there was only ten per cent difference between the check and the treated sample. Whether the subsequent development of these slow germinating seeds would be normal has not been determined. The seedlings appeared perfectly normal on the blotters.

TABLE 7. SEEDS IMMERSED IN LIQUID CS_2 FOR VARIOUS PERIODS

	Check	Treated
Corn, 24 hours	100	100
Corn, top of kernel cut off, 24 hours	100	100
Corn, top of kernel cut off, 8 days	100	86
Corn, punctured over scutellum, 24 hours	100	88
Corn, 10 days	100	92
Corn, 30 days	100	88
Wheat 2 hours	97	79
Wheat, 20 hours	97	44
Wheat, 43 hours	97	34
Oats, 24 hours	95	65
Soybeans, 24 hours	86	70

A point of importance in practical fumigation is the amount of injury which may be expected if the liquid bisulphide touches the seeds. It is commonly assumed that the injury will be much greater in this case. A few experiments conducted to test this are reported in Table 7.

Apparently there is no likelihood of injuring corn by any commercially practical treatment with bisulphide, since it withstood 30 days immersion in bisulphide with a loss in germination of only twelve per cent. Even then the seedcoat was punctured directly over the scutellum of the germ, 88 per cent of those immersed in bisulphide for twenty-four hours germinated. The other seeds showed much greater injury from immersion in the liquid than from treatment with the gas, but the injury was not sufficient to suggest any practical danger from pouring bisulphide directly on seeds for fumigation. In practice, we have done this for years without injury.

ON THE OYSTER-SHELL SCALE FOUND ON WILLOWS AT BOULDER, COLORADO[1]

By R. L. Shotwell, *Boulder, Colo.*

A heavy infestation of the Oyster Shell Scale (*Lepidosaphes ulmi*) has recently been discovered on willows in a small half-acre clump in Gregory Canon, Boulder, Colorado. The altitude of this particular spot is about 5600 feet. This insect has also been reported from other parts of the state, Fort Collins and Denver. That the insect was brought from Denver to this place on the feet of birds is the opinion of Dr. T. D. A. Cockerell.

The following trees and shrubs are found in the vicinity of the infested willows: two species of Populus (broad-leaf and narrow-leaf cottonwoods), Pinus (western yellow pine), Alnus (alders), Crataegus (thornapple), Prunus (wild plum), Acer (Rocky Mountain maple and box elder), and rosebushes. All of these are in close proximity to the willows, but do not have any of the insects on them. One small rosebush had a few scattered scales on it, but they were poorly developed. Prof. C. P. Gillette of Ft. Collins writes: "The lilac and ash trees in a city park in Ft. Collins are being killed by this scale, while a number of flowering crabs growing under these trees do not have any of the scales upon them. In fact we do not find *Lepidosaphes ulmi* on any of the apple trees here."

The following table shows the difference in the average number of

[1]Contribution from the Entomological Laboratory, University of Colorado.

circumgenital pores between specimens taken from willows in Gregory Canon, and those taken from Populus and Salix in Italy (Berlese and Leonardi; Chermotheca Italica) and Peach in Florida (Rolf and Quaintance, Coccidae Americanae). This table was worked out according to the method of Mr. P. A. Glenn in an article, "Forms of the Oyster Shell Scale in Illinois," JOURNAL OF ECONOMIC ENTOMOLOGY, April, 1920, 13:173–177. From a comparison of the two tables, this scale in Gregory Canon comes under what Mr. Glenn calls the grayish brown or banded form. The Italian specimens from the Populus and Salix fall in with his yellowish brown form, and those from the peach, with his brown or apple form. In this table the mode represents the number of pores found to occur most commonly in any one group. The averages and modes in most cases are very nearly the same. The variation curves for the number of pores in the different groups of specimens from the willows were also worked out according to the method of Grace H. Griswold (1922). These curves indicated that the Gregory Canon scale belongs to the lilac form though the modal number is higher. Presumably, therefore, it is not to be found as an enemy to the apple.

CIRCUMGENITAL PORES

Host Plant	Number examined	Posterior Lateral				Anterior Lateral				Median Group				Total average
		Max.	Min.	Aver.	Mode	Max.	Min.	Aver.	Mode	Max.	Min.	Aver.	Mode	
Willow, Boulder, Colo.	75	32	10	21.94	24	30	14	24.28	25	16	6	12.95	14	105.39
Willow, Boulder, Colo.	17	28	19	23.40	24	30	21	25.20	25	17	11	14	14	111.20
Populus, Italy	13	17	15	15.73	16	24	15	20.90	21	13	10	11.16	10	84.42
Salix, Italy	16	20	12	16.84	16-17	27	15	20.37	18-19	14	10	11.50	12	85.92
Peach, Florida	13	25	12	14.16	12-13	22	12	16.43	16	11	9	10.54	10	71.72

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GILLETTE, C. P. Letter of Jan. 9, 1923.

Scientific Notes

The Oriental Peach Moth, *Laspeyresia molesta* Busck. During the past two summers this insect has been noticeable on apple and peach. At times it has been more injurious than the lesser apple worm. This summer it has been found injurious especially on peach shoots, causing alarm to some orchardists in Adams County, Pa.

S. W. FROST, *State College, Pa.*

An Outbreak of the Apple Flea-Weevil. An outbreak of the "Apple Flea-Weevil" *Orchestes pallicornis* Say., has been found by Anthony Berg at Morgantown, West Virginia. Forbes (1911) first recorded it as a pest on apple under the name *Orchestes canus* Horn. The larvae mine the leaves of apple, cherry, elm and alder and the adults feed on the foliage, eating out small holes. The larvae transform in gall like pockets within the leaves. Larvae were reared at the State College laboratory Arendtsville, Pa., and the adults issued between June 8th and June 11th. The adults resemble flea beetles more than Curculionids in habits because their hind legs are enlarged and they are powerful jumpers. Records have been made of the adults feeding on the flowers of Amelanchier and on the leaves of willow. The species is widely distributed although is it not often taken as a pest. Mr. A. B. Champlain, who kindly determined the species, states that there is a long series of the species in the State Collection at Harrisburg. S. W. FROST.

Note on Occurrence of *Macrosiphum pisi* Kalt. on Scotch Broom. During the summer and early fall of 1921 a search was made on all wild legumes that might possibly serve as hosts for *Macrosiphum pisi* Kalt. October 7th, in the vicinity of Forest Grove, Oregon, males (both alate and apterous), oviparous females, and eggs of this aphid[1] were found on Scotch broom (*Cytisus scoparius*) which commonly grows wild in western Oregon and Washington as an escape from cultivation. It is especially abundant towards the seacoast where in places it lines the roadside for miles. Broom as a possible host for *Macrosiphum pisi* Kalt. was suggested by Mr. L. P. Rockwood because of its having been listed as a host for that aphid in Europe (Kaltenbach, 1874), though, so far as the writer knows, it has not been so listed for this country.

Eggs on broom began hatching March 11, 1922, the first stem mothers maturing April 25th. Alates appeared towards the end of the third generation (about June 1st) and in the fourth generation, but, contrary to expectations, they did not leave the broom this season, at least not in appreciable numbers. The fact that there was no vetch (their usual herbaceous host in this region) in the immediate vicinity may have had something to do with this. Most of the succeeding generations were apterous, the aphids continuing on broom during the entire summer, and sexual forms first appearing about September 18th, 1922, on which date two wingless males and one nymph were swept. Several oviparous females and males were taken two days later, and the first eggs were found September 23d. Oviparous females were much more numerous than males during this season, and the apterous males in turn were more abundant than the alate form. Viviparous females continued, along with the sexual forms, on the broom during the fall, all apparently disappearing early in December.

The aphids feeding on broom are somewhat smaller and of a duller green than those feeding on vetch, but in all other respects they are identical, and will readily transfer to vetch or clover. They will also reproduce on alfalfa and locust under insectary conditions, sexual forms and eggs being secured on the latter host.

The occurrence of *Macrosiphum pisi* Kalt. on broom is quite general in western Oregon and Washington, and the aphids have been collected from that host at Olympia, Kent, Tacoma, and McGowan, Washington; Eugene, Dallas, Forest Grove, Portland, Astoria, and Seaside, Oregon.

[1]Determined by A. C. Baker of the Bureau of Entomology.

Macrosiphum pisi has been very destructive at times on vetch and peas in the Northwest, an especially severe outbreak occurring in 1918.

SADIE E. KEEN *U. S. Bureau of Entomology, Forest Grove, Ore.*

Swarms of Aphids: During the week ending June 9, newspapers and telephone inquiries reported that swarms of aphids were present in the cities of Meriden and Waterbury, Conn., and on June 8, specimens were received from Waterbury. On June 8, Mr. Zappe collected specimens at his home, Mount Carmel, where they were so abundant in the air that his little daughter said to him: "Daddy, it's snowing." During the week ending June 16, similar swarms of aphids appeared in the center of the city of New Haven, and the writer observed them on Elm Street on the afternoon of June 16. The tops of automobiles and clothes were literally covered with aphids and pedestrians were brushing them from their faces. Mr. Rogers of this Department states that in Bridgeport swarms of aphids have been present for three weeks, and that one day in the city in catching a butterfly he also caught two or three hundred of these aphids in the net. Even at the date of this writing (July 3) aphids have not all disappeared in New Haven, and this morning Mr. Rogers ran into a swarm on Winchester Avenue. It is not certain that all of these aphids were of the same species, but those examined seemed to be identical and material submitted to Dr. A. C. Baker of the Bureau of Entomology has been identified as *Euceraphis deducta* Baker, a species described from Maine in 1917 (JOURNAL OF ECONOMIC ENTOMOLOGY, Vol. X, page 429). Birch is the host of this species and the swarms probably came from *Betula populifolia*, which is abundant around all of these Connecticut cities. In 1919, I recorded the presence of swarms of *Calaphis betulaecolens* Fitch (see JOURNAL OF ECONOMIC ENTOMOLOGY, Vol. 12, page 351) in New Haven, Conn., and at first I supposed the swarms of the present season were of that species. A microscopic examination, however, showed them to be different. Dr. Baker writes that "it is very interesting that this recently described species should become so abundant."

W. E. BRITTON

A Note on the Life History of the San Jose Scale (*Aspidiotus perniciosus*) in the South. It has been the consensus of opinion among entomologists that the winter is past by the San Jose scale in a half-grown condition. Numerous observations on this part of the insect's life history in northern latitudes prove this opinion to be well founded, however, in the South it has been found that the insect frequently passes the winter or parts of the winter as a full-grown adult. In taking data on the results of experiments for the control of the San Jose scale on peach trees in Georgia during the winter of 1922–23 both crawlers and full-grown females were observed on peach twigs during the months of January, February, and March. During these months the crawlers were noted to settle down and start the formation of the scale covering a few hours after emergence in the same manner as those that emerge during summer months. Several years previous both crawlers and full-grown females were observed on peach trees in Mississippi during November and December. The first winged male to be observed in Georgia during the winter of 1922–23 issued on Mar. 27, 1923. All stages of the San Jose scale from the crawling young to the full-grown females have therefore been observed each month during the winter in the South, and it is evident that in the latitude of the Gulf States the San Jose scale breeds almost con-

tinuously during a mild winter, and the increase during such years is remarkably rapid unless properly controlled by sprays.

OLIVER I. SNAPP and C. H. ALDEN,
U. S. Bureau of Entomology, Fort Valley, Georgia

The Green June Beetle (*Cotinis nitida* L.) as a Tobacco Pest. In spite of the fact that we have had two excellent bulletins devoted to this common southern pest within the last two years, I have been unable to find any mention of this insect as a tobacco pest. Yet I believe that it is not only a very common, but a very serious pest of tobacco beds in North Carolina, and undoubtedly in many other sections of the South. I have had reports for a number of years of serious injury to tobacco beds by "earthworms," but all such reports were made in the winter so that they could not be investigated. This past year, however, I was fortunate enough to trace these "earthworms" to their lair and found that they were the larvae of the common Green June Beetle (*Cotinis nitida L.*).

Tobacco beds offer ideal breeding grounds for the Green June Beetle, as the beds are invariably placed in new ground or other rich soil and heavily fertilized with stable manure. Perhaps the chief reason that this insect is not more injurious is that it is a common practice to move tobacco beds to a new location each year.

The injury to the tobacco plants by the larvae of the Green June Beetle consists not only of the disturbance to the root system by their tunnelling, but the actual destruction of the roots and stems as has been reported by other workers for common vegetables.

The best remedy for this pest on tobacco beds would seem to be the method of changing the location of the bed each year. If the bed must be placed in the same location, year after year, the best remedy is to spade the bed thoroughly, early in September and sterilize the soil with steam or spray it with kerosene emulsion.

Z. P. METCALF,
North Carolina State College and Experiment Station

JOURNAL OF ECONOMIC ENTOMOLOGY

OFFICIAL ORGAN AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS

AUGUST, 1923

The editors will thankfully receive news matter and other items likely to be of interest to our readers. Papers will be published as far as possible in the order of reception, except that papers of reasonable length may be accepted in the discretion of the editor for early publication, at $3.00 per page for all matter in excess of six printed pages; in the case of other matter, the maximum of 2,500 words is still operative. Photo-engravings may be obtained by authors at cost.

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Ventures into the unknown are by no means always happy. Such was the case in the recent attempted test in New Hampshire of the possibility of utilizing a dirigible for the application of a poisonous dust to forest trees. It was especially vexatious that a thorough test was so nearly accomplished. The incident simply emphasized the uncertainty of investigational work and by no means suggests that further efforts along this line are inadvisable, in spite of the months of work and planning rendered fruitless by untoward developments. It appears practicable to utilize some device for dusting forest trees from above. It is possible that the type of dirigible selected was not the best for the purpose in view. Some modification may bring about the desired result. There is no question as to the desirability of developing equipment which can be used, possibly in special cases only, for dusting forest trees from above. If there are no planes or balloons moderately well adapted to the purpose, modifications might be developed. It may be necessary to abandon both planes and balloons and solve the problem in an entirely different manner. It is evident that there is an increasing need for a relatively inexpensive method of destroying leaf feeding caterpillars in densely forested areas. The high powered spraying equipment of the present day represents a long step in advance of the methods of some years ago. Is it not reasonable to look for another step in the near future? We use water as a carrier. We are employing air as a distributor of poison. Is it not reasonably safe to ride on the "wings of the wind" and at the same time scatter an insecticide effectively? Possibly not with the present equipment. Is it too much to look for the development of such a method within five years?

Obituary

FRANK CUMMINGS COOK

Dr. F. C. Cook of the Insecticide and Fungicide Laboratory of the Bureau of Chemistry died in Dallas, Texas, June 19 following an operation for appendicitis. Death occurred as would undoubtedly have been the desire of one so enthusiastic and full of energy without illness long removing him from his work. In fact he was busily engaged in going over plans for investigations in the field and other preparations for the trip only forty hours before he was called upon to lay aside his labors permanently.

One of the most successful and pleasant cooperative undertakings among scientific men was begun in 1913 when the Bureau of Chemistry, Bureau of Entomology and Bureau of Plant Industry, with Dr. Cook representing the first, began a series of experiments in the destruction of fly larvae in manure. This investigation was continued through several seasons and resulted in the discovery of very successful methods of preventing fly breeding in manure by the application of borax or hellebore. These methods are now being applied extensively by entomologists and sanitarians in the United States and various parts of the world. This project completed, Dr. Cook was assigned to work on arsenicals in cooperation with Dr. McIndoo of the Bureau of Entomology and the results of this work have just appeared as Department Bulletin 1147, "Chemical, Physical and Insecticidal Properties of Arsenicals." During 1921 Dr. Cook began cooperative work with the Bureau of Entomology on the chemotropic responses of flies. The field investigations on this project were carried out in Texas since the immediate practical problem was the development of attractants and repellents for the protection of live stock from infestation by screw worms. A portion of three seasons was spent in Texas on this project and it was while engaged in this work that the fatal illness occurred. Very substantial progress was made in this investigation although only a preliminary report (JOUR. OF ECON. ENT., vol. 16, pp. 222-224) has been issued. Another cooperative project with the Bureau of Entomology in which Dr. Cook was engaged was the testing of various fumigants with a view particularly of finding more satisfactory methods of destroying insects in cars of grain.

Dr. Cook displayed marked versatility in his work and the rapidity with which he grasped the entomological aspects of a problem made him especially valuable in these investigations.

Dr. Cook entered the Bureau of Chemistry in 1904. He was a native of Connecticut and educated in Yale where he received the B. A. degree in 1900, M. A. in 1902 and M. S. 1904. In 1908 the Ph.D. degree was conferred upon him by the George Washington University. He was a delegate to the International Congress of Applied Chemistry, Rome, 1906 and London, 1909, and was a member of numerous chemical and other scientific societies.

He published numerous papers, some in collaboration with Drs. Wiley and Bigelow on the chemistry of food products, cold storage experiments with eggs, fowls, etc., enzymes, food metabolism, and the use of copper sprays and their effects on the growth and composition of potatoes.

In the untimely death of Dr. Cook the sciences of Chemistry and Entomology have sustained a most serious loss. His many associates in the Department, all of whom were his devoted friends, feel most keenly the loss of contact with this enthusiastic and energetic worker, his genial, buoyant personality and clean christian life.

F. C. B.

Current Notes

Dr. W. D. Hunter of the Bureau of Entomology, addressed the annual meeting of the Western States Plant Quarantine Board at Phoenix, Ariz., May 22.

Mr. A. E. Miller has started a series of experimental plantings of corn at Chillicothe, Ohio, to determine the comparative immunity from the attacks of corn ear-worm.

C. H. Hadley has been appointed Director of the Bureau of Plant Industry of the Pennsylvania Department of Agriculture.

Professor S. A. Forbes is spending the month of August in scientific work at Bowdoin College, Brunswick, Maine.

Mr. J. S. Houser, Associate Entomologist of the Ohio Experiment Station, visited the Kansas State Agricultural College during Commencement Week, May 26 to June 1. Mr. Houser graduated with the 1904 class.

The alfalfa weevil scouting work in Southern Alberta started under the immediate direction of Mr. H. L. Seamans on June 5th. Messrs. J. E. Featherstonnaugh and R. D. Murdock are doing the actual field work.

Prof. Z. P. Metcalf of North Carolina State College and Experiment Station has been granted a leave of absence and will spend the summer in study at the Bussey Institution, Forest Hills, Boston.

Dr. J. W. Bailey of Bussey Institute, Harvard University, is assisting Dr. F. C. Craighead for a few weeks in the study of the physiological conditions accompanying the death of budworm-injured balsam and spruce in Canada.

Dr. F. C. Craighead, accompanied by Dr. J. W. Bailey and R. C. Balch, recently appointed as temporary investigator of insect pests, left Ottawa on May 31st for a ten day study at the balsam sample plots at Long Lake, Que.

Dr. J. G. Needham, head of the Department of Entomology, Cornell University, was at the Kansas State Agricultural College July 5th and 6th, at which time he gave three addresses to the students and faculty of the summer school.

According to *Science*, Dr. William Morton Wheeler and other members of the Williams Galapagos Expedition arrived in New York the last week in May after a ten-week cruise among the Galapagos Islands, off the coast of Ecuador.

The scouting to determine the distribution of the apple sucker started in Nova Scotia on June 5th. Prof. W. H. Brittain is in immediate charge of the work and will be assisted by Messrs. George Makinson, and Mr. L. A. Coite.

Messrs. Luther Brown and J. H. Pressley of the Georgia State Board of Entomology are assisting with control experiments of peach insects that are being conducted at Fort Valley, Georgia, by the Bureau of Entomology in cooperation with the State Board.

Mr. C. H. Hadley, Jr., of the Bureau of Entomology, and in charge of the Japanese beetle work at Riverton, N. J., has been appointed Director of the Bureau of Plant Industry, Department of Agriculture, Harrisburg, Pa., and has already begun his work there.

Mr. A. C. Morgan, Bureau of Entomology, in charge of the Tobacco Insect Laboratory at Clarksville, Tenn., addressed gatherings of Burley tobacco growers in Gallatin, Columbia, and Shelbyville, Tenn., May 31 to June 2, his subject being the control of tobacco insects.

A report has been received from the north shore of Gaspe Peninsula that additional injury by *Dendroctonus piceaperda* has been discovered in several important stands of spruce. It is expected that this infestation will be investigated by Canadian officers in the near future.

Prof. A. E. Stene, State Entomologist and Director of extension work for Rhode Island, attended the Tri-State Conference of extension workers at Amherst, Mass., June 27–29, and the field meeting of the Connecticut Vegetable Growers' Association at New Haven on July 7.

Mr. C. M. Smith, detailed from the Bureau of Chemistry to investigate the chemical and physical properties of calcium arsenate and the influence of various factors in the application of this insecticide to the cotton plant, has started on field work for the season at Tallulah, La.

Prof. Dwight M. DeLong of the Ohio State University has been raised from the rank of Assistant Professor to Professor of Entomology, and will have charge of the teaching work in Economic Entomology at that institution.

According to *Science*, Mr. E. M. Ehrhorn, Entomologist, Board of Commissioners of Agriculture and Forestry, Honolulu, H. I., has been appointed by the National Research Council as one of the American Delegates to the Second Pan Pacific Scientific Congress to be held at Sydney and Melbourne, Australia, from August 13 to September 3.

Mr. C. H. Popenoe, Bureau of Entomology, Entomologist in Truck-Crop Insect Investigations, has been authorized to devote his entire time to fundamental re-

search work in insect behavior and chemical control, and will establish headquarters at the laboratory at Sligo, Md., where investigations of fruit insects and truck-crop insects are being conducted.

At the Connecticut Agricultural Experiment Station, New Haven, Mr. R. C. Botsford is now in charge of the mosquito work in place of Samuel T. Sealy, who resigned April 1. Messrs. J. Leslie Rogers and T. J. Cronin are employed temporarily in the Entomological Department to assist in the field experiments and in nursery inspection.

Mr. L. L. Huber is in charge of the laboratory for the investigation of the European Corn Borer at Geneva, O. Plantings of varieties of early corn to test maturing qualities and comparative immunity from attack are now being made. Life-history cages will be started as soon as material can be collected for this purpose.

On April 30, Dr. F. C. Craighead of the Canadian Entomological Branch left for Fort Francis, Ont., to meet Dr. S. A. Graham of the University of Minnesota, and visit the area attacked by the spruce budworm. It is expected that a cooperative study of the outbreak in western Ontario and northern Minnesota will be arranged.

For the purpose of cutting down expenses, some of the work of the Bureau of Biological Survey has been curtailed and Mr. Henry L. Viereck has been obliged to seek a position elsewhere. At present he is employed temporarily in systematic work with Hymenoptera at the Entomological Branch, Canadian Department of Agriculture, Ottawa, Can.

Recent appointments in the Entomological Branch, Canadian Department of Agriculture, have been announced as follows:—T. Armstrong, Assistant Junior Entomologist for the Montreal district, vegetable crop insects: N. J. Atkinson, temporary entomologist, Saskatoon Laboratory: G. A. Ficht, temporary junior entomologist, Port Stanley Laboratory: R. Ogburn, seasonal assistant, systematic entomology to collect insects, particularly Ephemeridae and Odonata around Ottawa.

Mr. C. R. Neiswander has been appointed to assist Mr. Huber in the corn borer investigations, of the Ohio Station. Mr. Neiswander has his master's degree from Ohio State University. He commenced work at the Geneva Laboratory May 30. Messrs. Huber and Neiswander came to Wooster June 6 to get further equipment for the Geneva laboratory.

Mr. W. H. White, Bureau of Entomology, has just returned from Seaford and other points in Delaware, where, in company with C. C. Woodbury of the National Canners Association, he made general observations tending toward a better knowledge of the practical control of the pea aphis on cannery peas with nicotine dusts, applied by high-power apparatus.

Mr. J. E. Dudley, Jr., Bureau of Entomology, in charge of the investigation of the pea aphis in its attacks on cannery peas, has been authorized to assume temporary headquarters at Columbus, Wis., where he will undertake cooperative control experiments and studies throughout the pea-growing season, in cooperation with State Entomologists and the Columbus Canning Co.

Messrs. W. D. Edmonston and George Hofer of the Bureau of Entomology are at present on the Kaibab National Forest and Grand Canyon National Park, where control work is being conducted in cooperation with the Forest Service of the De-

partment and the National Park Service of the Interior Department against the Black Hills beetle, *Dendroctonus ponderosae* Hopk.

The Department of Entomology of the Ohio Station is giving the red engine oil emulsion which has proven so successful in controlling severe outbreaks of San Jose scale in Illinois and Arkansas a thorough trial in Ohio. This season tests on apple are being conducted at Painesville, Youngstown and Chesapeake; on peach at Danbury; and on plum and currant at Waterville.

Many arborvitae and boxwoods in the vicinity of Washington, D. C., are suffering from attacks by two leaf-miners—the lepidopterous arborvitae leaf-miner and the dipterous boxwood leaf-miner. Mr. William Middleton of the Bureau of Entomology is investigating these insects in this locality, particularly the infestation of the arborvitae leaf-miner in the Arlington National Cemetery, Arlington, Va., where it is especially severe.

It is announced that Dr. F. C. Craighead has been appointed head of the Division of Forest Insects of the Bureau of Entomology, beginning about September 1, 1923. Dr. Craighead was formerly connected with the Bureau, but resigned a few years ago to accept a position in the Entomological Branch of the Canadian Department of Agriculture, where he has since been specializing in forest insect work.

The following recent appointments to the Bureau of Entomology have been announced: John F. Cotton, Cornell University, laboratory aid for the summer, stored-product insects; Victor Duran, truck crop pests; A. D. Shaftsbury, Bruce Lineburg, Paul E. Smith, Effie Marie Ross, Mary G. Rozelle, Professor L. M. Bertholf of the North Carolina College for Women, and B. Kurrelmeyer of Johns Hopkins University, temporary assistants in bee culture investigations.

Dr. J. H. McDunnough, Chief of the Division of Systematic Entomology, Canadian Department of Agriculture, spent May 1 and 2 in Toronto, examining some of the type specimens of Ephemeridae in the Toronto University Museum. On May 7 he left for Boston, Mass., to examine types and specimens of interest in various orders in the collections at the Boston Museum of Natural History, and the Harvard Museum at Cambridge.

According to the *Official Record*, Mr. John E. Graf has been made acting head of the Division of Truck Crop Insect Investigations of the Bureau of Entomology. Mr. Graf has recently been located at Birmingham, Ala., but will now be at Washington. Dr. F. H. Chittenden, who for many years has been in charge of this Division, will devote his time in the future to special studies of truck crop insects and to taxonomic work.

The Tri-State Conference of extension workers of Massachusetts, Rhode Island and Connecticut was held at Amherst, Mass., June 27-29. The following papers were presented before the conference by entomologists:—Apple and Thorn Skeletonizer and European Red Mite, by W. E. Britton: Present Status of Gipsy Moth Control by A. F. Burgess: The Organization and Work of the Crop Protection Institute by W. C. O'Kane: Discussion of Orchard Insect Pests with Specimens, by Arthur I. Bourne.

Mr. R. A. St. George of the Bureau of Entomology, left Washington May 20 for points in Kentucky, Georgia, Mississippi and Alabama, to supervise the cooperative experiments with lumber companies intended to prevent insect damage to green logs and lumber by ambrosia beetles and borers, and also damage to seasoned products by

Lyctus powder-post beetles. Mr. St. George is also to report on the present status of an epidemic of the southern pine beetle, *Dendroctonus frontalis* Zimm.

According to *Science*, the attention of entomologists throughout the world is called to the fact that, beginning with the volume for 1922, the preparation of the "Insecta" part of the *Zoological Record* is being undertaken by the Imperial Bureau of Entomology. In order that the *Record* may be as complete as it is possible to make it, all authors of entomological papers, especially of systematic ones, are requested to send separata of their papers to the bureau. These are particularly desired in cases where the original journal is one that is not primarily devoted to entomology. All separata should be addressed to the assistant director, Imperial Bureau of Entomology 41 Queen's Gate, London, S. W. 7, England.

Mr. W. N. Keenan of the Division of Foreign Pests Suppression spent ten days in Southern Ontario in connection with the European corn borer work, where he arranged for the inspection of cut flowers and vegetables for export to the United States and also for the maintenance of the quarantine. Warning posters are being placed at all road intersections leading out of the quarantined area, informing the general public that it is against the law to remove corn from the infested districts.

An experimental demonstration was started by the Bureau of Entomology nearly two years ago with a local business firm, in which the Bureau undertook to eliminate loss for the two-year period to stocks of brushes by fumigation with hydrocyanic acid gas. The company provided a room in which to store their stocks and in which they could be fumigated without moving. The experiment has demonstrated the possibility of preventing losses of this kind by the methods adopted, and the company has been the gainer by several thousand dollars annually.

The temporary parasite laboratory at St. Thomas, Ontario, with Mr. A. B. Baird in charge, is now well under way and owing to the extensive and well organized "clean-up" campaign, instituted by the Division of Field Crop and Garden Insects, it has been a difficult task to secure enough hibernating European corn borer larvae for the breeding of the parasites. By transferring men from other lines of work it was possible to collect 26,000 larvae up to June 1st. Mr. H. A. Dyce of the University of Toronto, has been appointed to assist Mr. Baird.

Dr. H. L. Dozier resigned his position as Entomologist, U. S. Bureau of Entomology in charge of the Camphor Scale Investigation Laboratory at New Orleans, La., April 1st, to accept the position of Entomologist for the Gulf Coast Citrus Exchange in charge of their research and field service problems, dealing primarily with the Satsuma orange. A fully equipped office and laboratory has been established at Houston St., I. S. of Government, Mobile, Ala., to carry out these investigations. Much progress has been made during the past fall and winter in cleaning up the purple and camphor scale on the Satsuma orange in Southern Alabama, using standard oil emulsions.

The following amendments to the Regulations under the Canadian Destructive Insect and Pest Act were recently passed: Amendment No. 19, passed May 31, 1923, prohibiting the importation of certain cut flowers and vegetables from the areas infested by the European corn borer in the United States (Amendment brings up to date the old regulation). Amendment No. 20, passed June 4, 1923, amends the previous regulation by adding European Buckthorn (*Rhamnus cathartica* L.) to the list of plants prohibited entry, on account of its being a host of the disease causing

crown rust of oats. Amendment No. 21, passed June 4, 1923, a domestic regulation amended by adding European Buckthorn to the list of plants prohibited entry into Manitoba, Saskatchewan, and Alberta from the other provinces of Canada.

Dr. J. M. Swaine, Associate Dominion Entomologist, left Ottawa on April 24 for a ten days' trip to Washington, Philadelphia, New York and Boston, for the purpose of comparing specimens of the genus *Leptura* with types located in the various museums in the cities mentioned. This work is preparatory to a revision of the genus which Dr. Swaine is undertaking in cooperation with Mr. Hopping. Dr. Swaine arrived in Washington during the first part of May. Dr. Hopkins showed Dr. Swaine the Forest Insect collections, particularly the Scolytidae. Dr. Swaine also visited the Eastern Field Station at East Falls Church, Va. On May 2 Dr. Swaine with Dr. Snyder visited Ashland, near Richmond, Va., where control operations were being conducted against the southern pine beetle, *Dendroctonus frontalis* Zimm. Termites or white ants were found to constitute, as usual, one of the principal factors in rapidly rendering standing beetle-killed timber unmerchantable.

The Louisiana Entomological Society was organized with 26 members three years ago, largely through the efforts of Mr. Ed. Foster of New Orleans who has served as President for the past three years. While no special effort has been made to secure new members, the membership has grown to 47, including one honorary member, Dr. L. O. Howard, Chief of the Bureau of Entomology, U. S. Department of Agriculture. Meetings are held five times a year, four being held in New Orleans and one in Baton Rouge. The Society was organized by professional entomologists of the State, for the purpose of advancing knowledge of insects and the Society always welcomes, either as members or visitors at meetings, those who are interested in insects. With this in mind it has been the policy to arrange programs, consisting of short talks, moving pictures, and insect exhibits, that will appeal to all those interested in insect life. Officers for the present year are:—President, T. H. Jones, Entomologist of the Experiment Station, Louisiana State University; Vice-President, Dr. H. T. Mead, Professor of Zoology, Tulane University; Secretary-Treasurer, Ed. Foster, New Orleans; members of Executive Committee, E. R. Barber, Barber Entomological Laboratories, New Orleans, James M. McArthur, New Orleans, and W. G. Bradley, Assistant Entomologist, Experiment Station, Louisiana State University; Publicity Secretary, E. R. Barber.

Prof. James G. Sanders severed his connection on July 1 with the Pennsylvania Department of Agriculture, where since 1917 he has been Director of the Bureau of Plant Industry. He came to Pennsylvania from the University of Wisconsin at the request of the Agricultural Commission to organize the nursery inspection service, and to establish a Bureau of Economic Zoology (later becoming the Bureau of Plant Industry), which should provide a means for controlling insect and plant disease outbreaks, and in addition be a valuable factor in the economic field of entomology and plant pathology in the state. Since that time the Bureau has been built up in various directions to include such activities as: the building of a fine insect collection, the establishment of a state herbarium and a plant disease collection, the organization of seed inspection, apiary inspection, nursery inspection, and potato seed certification, and the equipment of five field laboratories for research into the control of insects and diseases. His well known energy and ability have been important factors in dealing with two of the most outstanding national quarantine problems of

recent years, namely the potato wart and the Japanese beetle, and the success of enforcement in these is in no little measure due to his organizing genius and untiring efforts. By the withdrawal of Mr. Sanders the State of Pennsylvania loses a powerful force that was wholeheartedly devoted to its agricultural progress.

A cotton boll weevil laboratory and field station has been opened at Florence, S. C., under a cooperative project between the Bureau of Entomology and the South Carolina Experiment Station, with Dr. N. E. Winters in charge. Early in May Mr. Coad spent a few days at Florence, conferring with Prof. Barre, Prof. Conradi, and Dr. Winters, relative to the plans for this season's experiments. Messrs. H. C. Young and V. V. Williams of the main Boll Weevil Laboratory at Tallulah, La., have been detailed to the Florence station. In addition, a number of entomologists will be employed. Plans were made to study primarily the particular point of weevil biology and behavior which have local significance in connection with control measures. Extensive tests are planned to include the field use of all of the principal suggested measures of control, such as the dusting method, the Florida method, and the use of sweetened poisons. In addition to the work at Florence, certain of these experiments will be repeated at Clemson College and several other points in the State, representing the principal topographical districts. The experimental work to be conducted at the Boll Weevil Laboratory at Tallulah, La., relative to the use of airplanes for distributing poison dust for the control of the boll weevil is now under way. In April, three De Haviland 4B planes were detailed by the Air Service for use in this work in cooperation with the War Department. These planes are under the command of First Lieut. Guy L. McNeil, who served on this same project last season; Allen L. Morse, an aeronautical engineer from McCook Field, Dayton, Ohio, was also detailed for duty on this project and arrived at Tallulah shortly after the arrival of the planes. It has been found that owing to the different behavior of the DeHaviland planes, as compared with the small Curtis plane used in the experiments conducted last year, the dusting problem becomes quite different, and the mechanical problem of providing suitable distributing mechanism is very complicated. Several types of dust hoppers have been constructed for use in these planes. This phase of the work is still in an experimental stage and it will require considerable time and experimentation before a final design for a hopper can be decided upon. Mr. Coad, who is in charge of the Boll Weevil Laboratory, hopes to have a fairly satisfactory permanent hopper installed in at least one of the planes in time to use it in actual control work during the summer months. Several plantations near the landing field have been mapped and all arrangements made for poisoning the cotton on these in an effort to accomplish boll weevil control through the season.

Apicultural Notes

Mr. Arthur C. Miller, Providence, R. I., an authority on beekeeping, died at his home, June 11, in the 61st year of his age.

Mr. A. P. Sturtevant of the Bureau of Entomology appeared before a board of experts on May 29 to defend his thesis presented for his doctor's degree at the George Washington University at commencement in June. His thesis is entitled: "The Development of American Foulbrood in Relation to the Metabolism of its Causative Organism."

Mr. Paul E. Smith, Miss Effie Marie Ross and Miss Mary G. Rozelle have been appointed by the Bureau of Entomology as temporary aids for a continuation of the work on the temperature of the bee colony during the active season which was done last year. This year the work will be carried out only during the period of the heavy honey flow from tulip tree during the month of May, in order to get additional data for this important period.

Because of the present economic conditions in Germany, the Berlin Bieneninstitut is in danger of being entirely discontinued. To prevent this an effort is being made in the United States to raise funds sufficient to insure the continuation of the valuable research work of this institute. Dr. Ludwig Armbruster, Director of the Institute, is also editor of the *Archiv für Bienenkunde*, the only strictly scientific journal devoted to bees and beekeeping, and the aid to the institute will probably insure a continuation of this journal.

Messrs. A. D. Shaftesbury, Bruce Lineburg, and B. Kurrelmeyer of Johns Hopkins University and Prof. L. M. Bertholf of the North Carolina College for Women have been appointed as temporary assistants in the Bureau of Entomology beginning June 1. These men were all at the Bee Culture Laboratory last summer studying special problems for which material is available only in the summer and are returning to continue the same studies. Mr. Lineburg will receive his master's degree in June and his thesis will consist of the results of the work done last summer, the paper being entitled: "Feeding of Honeybee Larvae."

Wisconsin beekeepers will keep "Open House" to the beekeepers of the United States for one week during their fifth annual conference at Madison, Wisconsin, August 13 to 18. The entire conference will be dedicated to Dr. Charles C. Miller, one of the greatest and most beloved of beekeepers. Prof. H. F. Wilson of the Wisconsin College of Agriculture will preside at all meetings. The Charles C. Miller Memorial Apicultural Library, which is now a part of the Wisconsin Agricultural Library, will be dedicated on Friday, August 17. Contributions for this library have been received from many countries so that it is an international monument to the beekeeping industry as well as to Dr. Miller. A pilgrimage by automobile to the former home of Dr. Miller at Marengo, Illinois, will take place on Saturday, August 18. A special service will be held there and a tablet in memory of Dr. Miller placed in the Presbyterian church with which he was connected for many years. All of Dr. Miller's friends are invited to attend the ceremony at Marengo. Four members of the staff of the Bee Culture Laboratory of the Bureau of Entomology will have part in this meeting. Dr. S. B. Fracker, State Entomologist of Wisconsin, is also on the program. Prominent workers in beekeeping from all parts of the United States will speak, and this is expected to be one of the greatest beekeeping conventions ever held. During the week, papers will be given on Habits of Bees; Division of Labor among Bees; Digestion of the Worker Bee; Field Trips made by Individual Bees; Temperature of the Bee Colony in Spring, in Summer, and in Winter; Humidity in the Hive; Instinctive Mechanisms of Bees and Swarming Behavior; Behavior as Influenced by Locality; Bee Disease and Extension Problems.

Horticultural Inspection Notes

Mangoes from Jamaica arriving at Philadelphia and New York during the months of May and June were found by Messrs. Max Kisliuk, Jr., and Emile Kostal to be

infested with larvae of what appeared to be the West Indian Fruit Fly, *Anastrepha fraterculus* Wied.

During the race of a fleet of passenger vessels to land thousand of immigrants at New York on July 1, 1923, many interesting interceptions of contraband plant material were made. The material intercepted included a species of *Colocasia*, green corn, and Irish potatoes.

Mr. L. R. Dorland, who is in charge of the activities of the Federal Horticultural Board at Nogales, Arizona, attended the conference of the Western Plant Quarantine Board at Phoenix, Arizona, during the month of May.

Mr. Lee A. Strong, Chief, Bureau of Plant Quarantines, State Department of Agriculture of California, visited Washington, D. C., during the month of June for the purpose of consultation.

Oranges, taken by Mr. A. C. Fleury, collaborator of the Federal Horticultural Board at San Francisco, Calif., from the baggage of a passenger on a vessel arriving from Japan, were found to be infected with Citrus Canker.

Prof. R. Kent Beattie, of the Federal Horticultural Board, visited various points in New England during the month of June for the purpose of checking over plants entered under special permit.

Inspector P. E. Lewis, of the California State Department of Agriculture, on May 22 collected larvae of the Mediterranean Frui Fly, *Ceratitis capitata* Wied., in rose apple (*Eugenia jambos*) which arrived in San Francisco from Hawaii.

Mr. E. R. Sasscer, of the Plant Quarantine Inspection Service, Federal Horticultural Board, visited various maritime and Mexican border ports during the month of July for the purpose of consulting customs officials and representatives of the Board.

The Avocado Weevil, *Heilipus lauri* Boh., was taken by Messrs. R. B. Haller and M. M. Richardson in avocadoes for sale in Piedras Negras, Mexico, during the month of June. This same insect was also found by Mr. O. D. Deputy in avocadoes for sale in a Matamoros market.

An interesting chestnut weevil, *Balaninus* sp. was collected by Mr. H. Y. Gouldman at the Inspection House, Washington, D. C., the nuts coming from Yunnan, China. Apparently this weevil differs from that which attacks chestnuts in the United States.

Mr. R. D. Kennedy, plant quarantine inspector with the Federal Horticultural Board, who for the past two years has been stationed in Washington, D. C., was transferred on July first to New York City to assist in the plant quarantine inspection work at that port.

Orchids (*Aerides Lawrenceanum* and *Vanda Sanderiana*) introduced under special permit from the Philippine Islands recently arrived in Washington, D. C., infested with what appears to be a new species of *Chionaspis*. Mr. W. B. Wood, who inspected the material, also found the plants infested with *Parlatoria proteus* (Curtis) and mealy bugs, *Pseudococcus* sp. closely related to *P. citri* (Risso) and *P. lilacinus* (Ckll).

Mr. L. C. Griffith, of New York, visited Boston during the month of June for the purpose of assisting Mr. R. I. Smith in the testing of the new sterilization plant installed in Charleston by the Terminal Wharf and Railroad Warehouse Company.

The cylinder, which has been approved, is 50 feet long and 9 feet in diameter, and may be used either for fumigation or sterilization work.

The cotton fumigation plant operated by the California Cotton Mills Company and formerly located at Seattle, Washington, has been moved from that city to San Francisco, Calif. This leaves but one cotton vacuum fumigation plant in Seattle. The fumigation plant operated by this same company at Oakland, Calif., has been equipped for sterilization work, and the entry of broom corn is now permitted at that port.

Fumigation facilities now being available at Portland, Ore., this port has been opened for the entry of baled cotton. The fumigation plant was constructed by Mr. Harry Leckenby, and the cylinder of the fumigatorium is 67 feet long and 6½ feet in diameter. It is conveniently located on the docks, avoiding the necessity of a long haul after the cargo has been discharged.

Green chickpeas in the pod were found by Mr. Emile Kostal, of New York, to be infested with the following insects: *Heliothis virescens* Fab. in peas from Porto Rico, Jamaica, and Barbadoes; *Etiella zinkenella* Trist. in peas from Porto Rico; and *Ancylostomia stercorea* Zeller in peas from Jamaica and Trinidad.

Prof. David Lumsden visited various points in the state of New York during the latter part of June examining plants imported under special permit. While at Rochester he collected in Highland Park adults of the Oblong Leaf Weevil, *Phyllobius oblongus* Linn., feeding on elm. Apparently this is the first record of the occurrence of this common European insect in the United States. An immediate investigation of the Rochester infestation will be made.

Mr. A. C. Fleury reports that through the vigilance of one of the inspectors of the State Department of Agriculture of California there was intercepted at San Francisco in the baggage of a passenger arriving at that port from Honolulu, H. T., several cotton bolls containing cotton seed which upon examination were found to be infested with living larvae of the Pink Bollworm, *Pectinophora gossypiella* Saund. The owner of the cotton bolls claimed that she had received them from the Manchester New Hampshire Cotton Mills, and that they had been sent to her for the purpose of teaching textiles.

Inspectors of the Federal Horticultural Board stationed on the Mexican Border have found mangoes from the interior of Mexico during the months of May and June to be infested with the Mexican Fruit Fly, *Anastrepha ludens* Lw. These larvae were taken at Matamoros, Nuevo Laredo, Piedras Negras, and Juarez. It was difficult to determine definitely the origin of the fruit, although some of it was reported to have come from the state of Jalisco. An inspector of the California State Department of Agriculture also intercepted this insect in mangoes found in the ship's stores of a vessel arriving at San Pedro from Mexico.

The following interesting interceptions have been made by inspectors of the Florida State Plant Board:

Coccus viridis (Green), the green scale, was intercepted from Nassau in three different shipments. Nine shipments from the Bahama Islands showed an infestation of *Pseudaonidia articulatus* (Morg.) and *Aspidiotus destructor* Sign. was taken on three occasions on cocoanuts and four times on bananas from Cuba. Yams from Cuba and Grand Cayman were infested with *Targionia hartii* (Ckll.).

Mr. U. C. Zeluff, stationed at Tampa, Florida, collected oranges on a ship from Tampico, Mexico, infested with the Mexican Fruit Fly, *Anastrepha ludens* Lw.

Mexican-grown Irish potatoes used as ship's stores have during the past three years been found to contain larvae of an injurious weevil. In April of the present year, Mr. Clyde P. Trotter, inspector of the Federal Horticultural Board stationed at Galveston, Texas, collected additional larvae of this weevil and in this instance adults were reared by Mr. L. L. Spessard and identified by Dr. E. A. Schwarz, of the National Museum, as *Epicaerus cognatus* Sharp. This weevil is not known to occur in the United States and all inspectors engaged in port inspection work should carefully examine potatoes for this pest. Infested potatoes are usually found during the spring months. Thus far it has been impossible to determine definitely the exact origin of the potatoes, although they are usually taken on board at Vera Cruz, Mexico.

Mr. H. B. Shaw, in charge of the work of the Federal Horticultural Board at New York City, reports the following incident as demonstrating the necessity for close supervision of prohibited plant products brought to a port of the United States en-route to a foreign country:

845 sacks of cotton seed infested with larvae of the Pink Bollworm, *Pectinophora gossypiella* Saund., recently arrived at New York from Porto Rico for trans-shipment to England. The presence of the Pink Bollworm in the cotton seed not only necessitated the cleaning of the hold of the vessel which brought the cotton seed to New York, but also the cleaning of the lighter and the pier over which the cotton was trucked. It was also necessary to issue written instructions to the steamship company to have the hold of the vessel carrying the seed to England cleaned on its arrival at Southampton.

Mr. J. W. O'Brien, a plant quarantine inspector of the Federal Horticultural Board located in New York City, in cooperation with the customs officials, recently intercepted living larvae of the European Corn Borer in stalks of broom corn contained in passenger's baggage. This material was taken from the baggage of a third class passenger arriving from Italy, who proposed to take it to Missouri. Subsequent to this interception, Mr. O'Brien discovered a similar collection in the baggage of a passenger arriving from Germany.

Notes on Medical Entomology

Dr. F. C. Cook of the Insecticide and Fungicide Board, U. S. Dept. of Agriculture, died on June 19 at Dallas, Texas, following an operation for appendicitis. Dr. Cook had been in Dallas nearly a month working with the agents of the Bureau of Entomology on the chemotropic responses of various flies.

Mr. R. W. Wells, who has been engaged for several years in the Bureau of Entomology working on insects affecting live stock, resigned during July to enter commercial work.

On June 27 a conference was held at Del Rio, Texas, in connection with a meeting of the Sheep and Goat Raisers Association of Texas to consider ways and means of carrying out further experiments with scab mites, particularly along biological lines. At this conference the Texas Experiment Station was represented by Director Youngblood and Professor Jones, the experiment sub-station at Sonora, Texas by Dr.

Bennett and Mr. Peters, the State Livestock Sanitary Commission by Mr. Boog-Scott and Mr. Rasco, and the Bureau of Entomology by Messrs. Laake and Babcock.

According to Dr. F. C. Bishopp, on June 23 five cases of dengue fever had been reported to the health department in Dallas, Texas. The first of these occurred about the middle of the month. A number of cases of dengue have also been reported from Denton, Texas. Yellow fever mosquitoes are already fairly numerous and it is possible that the disease may again assume epidemic form.

After spending several months in Baltimore, Dr. W. V. King of the Bureau of Entomology has returned to Mound, La., and resumed active charge of the Malaria Mosquito Laboratory at that place. While in Baltimore, Dr. King cooperated with Johns Hopkins University, working up a vast number of statistical data relating to notes on malaria mosquitoes collected at Mound.

According to *Science*, Dr. George E. Beyer, Entomologist of the State Board of Health, New Orleans, La., formerly adjunct professor in biology, Tulane University School of Medicine, has been requested to aid in stamping out malaria in San Domingo, and has been granted a leave of absence for that purpose.

Pacific Slope Notes

Mr. H. E. Burke, Bureau of Entomology, completed the requirements for the Ph.D. degree at Leland Stanford Junior University in June. Mr. Burke's major is entomology, with work on the Pacific flathead borer, and his minor is physiology, with work on The Taxic Responses of the Lead-Cable Borer.

Mr. R. E. Campbell, Bureau of Entomology, reports successful results in the control of the pea aphis on cannery peas in southern California, as the result of extensive experiments undertaken in the vicinity of San Jose. The experiments indicate that sufficiently inexpensive control measures will be worked out in the near future.

Prof. H. J. Quayle, professor of entomology in the Citrus Experiment Station and Graduate School of Tropical Agriculture of the University of California, has been granted a period of sabbatical leave for six to twelve months, during which time he will visit Australia to study fumigation problems, assist growers in fumigation methods, and conduct trials of materials in continuation of experiments begun in California, thus securing data in advance of the next fumigating season in California.

Adult dried fruit beetles, *Carpophilus hemipterus* Linn., have been found by G. H. Vansell feeding on freshly cut Cheddar cheese in the storage room of the Creamery at the University Farm, Davis, California. It is supposed that the beetles flew in at the unscreened open ventilators which are only a few feet from a row of fig trees. The dried fruit beetle is frequently found on the partially dried fig in California and in the absence of fruit during the spring months they have apparently turned to the cheese for food.

On June 2, the Department of Entomology of the University of California and the staff of the Museum of the California Academy of Sciences gave at the Hotel Stewart, San Francisco, a complimentary dinner to Professor and Mrs. T. D. A. Cockerell, who were passing through San Francisco on their way to Siberia in quest of fossil insects. Thirty-six were at the table, including many of the biological workers of

the bay region of California. Dr. Barton W. Evermann acted as toastmaster, and all present joined in wishing their guests a pleasant voyage.

The Modesto, Calif., Chamber of Commerce appointed a committee to interview the Board of Supervisors regarding the seriousness of the bean weevil situation in Stanislaus County. Following a conference with the Farm Center Directors, the Chamber of Commerce extended to A. O. Larson, of the Bean Weevil Investigations at Alhambra, an invitation to visit the county and discuss the bean weevil situation at different places, with the view to securing widespread interest in better control methods for this pest. Mr. Larson's work has been highly commended by Lester F. Baker, Chairman of the Bean Weevil Committee of the Modesto Chamber of Commerce.

North Eastern Summer Field Meeting

The summer field meeting of the entomologists of the north-eastern United States, was held in Connecticut July 26 and 27, the trips from one point to another being made by automobile. The members gathered on the afternoon and evening of July 25, at New Haven where they spent the night, Hotel Taft being the headquarters. The next morning they visited the entomological department of the Agricultural Experiment Station, New Haven, the Station farm at Mount Carmel, West Rock Park, Yale bowl, Harkness Memorial Quadrangle, and the orchard of F. N. Platt, Milford, where spraying and dusting experiments are being conducted. From this point the party proceeded along the coast to the State Park at Hammonasset Beach, Madison. Following the luncheon, there was a base ball game (Worthley, umpire); some of the entomologists went bathing while others collected insects along the beach. Late in the afternoon, the party went northward passing Wesleyan University at Middletown, stopping at the large greenhouse and nursery establishment of the A. N. Pierson Co., Cromwell, viewed the gigantic elm tree in Wethersfield, and then to Hartford, where at the Hotel Bond a dinner and evening meeting had been arranged.

An interesting lecture on the Japanese beetle, illustrated by lantern slides, was given by Mr. Loren B. Smith of Riverton, N. J., in place Mr. C. H. Hadley, who could not be present. Friday morning the party drove through Keney Park to the tobacco sub-station at Windsor, and visited the forest experimental plots at Rainbow, returning via Elizabeth Park, to Hartford, where luncheon was served in the State Capitol. After luncheon the visitors were shown about the Capitol and the State Library, then drove via Rockville, to the Connecticut Agricultural College at Storrs. Here a demonstration of high-power spraying of woodland and orchard trees was given by the gipsy moth forces. After supper there was a base ball game between the Connecticut gipsy moth men and a team picked from the visitors (Burgess, umpire). In the evening motion pictures were shown in the armory, including those on the European corn borer, and the gipsy moth, prepared by the U. S. Department of Agriculture.

Officers elected for next year are; Chairman, H. E. Hodgkiss; Secretary, C. H. Hadley. The members expressed a desire to hold the next field meeting in the vicinity of Philadelphia in 1924.

The following were present; H. A. Ames, Somerville, N. J.; J. T. Ashworth, Danielson, Conn.; E. A. Back, Washington, D. C.; D. N. Borodin, New York, N. Y.

H. L. Blaisdell, Melrose,Mass.; R. C. Botsford, New Haven, Conn.; W. E. Britton, New Haven, Conn.; F. E. Brooks, Washington, D. C.; A. F. Burgess, Melrose Highlands, Mass.; C. W. Collins, Melrose Highlands, Mass.; C. R. Crosby, Ithaca, N. Y.; S. M. Dohanian, Somerville, Mass.; E. P. Felt, Albany, N. Y.; Philip Garman, New Haven, Conn.; Hugh Glasgow, Geneva, N. Y.; F. W. Graves, Melrose Highlands, Mass.; Melvin Guptill, Sudbury, Mass.; T. L. Guyton, Harrisburg, Pa.; E. A. Hartley, Melrose Highlands, Mass.; G. W. Herrick, Ithaca, N. Y.; T. J. Headlee, New Brunswick, N. J.; H. E. Hodgkiss, State College, Pa.; C. E. Hood, Melrose Highlands, Mass.; J. L. Horsfall, Bustleton, Pa.; J. F. Jamieson, Riverton, N. J.; R. W. Kelley, New York, N. Y.; G. H. Lamson, Storrs, Conn.; F. H. Lathrop, Highland, N. Y.; M. D. Leonard, Albany, N. Y.; Q. S. Lowry, Boston, Mass.; J. A. Manter, Storrs, Conn.; C. W. Minott, Melrose Highlands, Mass.; F. H. Mosher, Melrose Highlands, Mass.; H. L. McIntyre, Albany, N. Y.; A. H. Parkins, Boston, Mass.; Alvah Peterson, New Brunswick, N. J.; D. M. Rogers, Boston, Mass.; J. V. Schaffner, Melrose Highlands, Mass.; A. F. Schulze, Storrs, Conn.; R. A. Sheals, Providence, R. I.; L. B. Smith, Riverton, N. J.; A. E. Stene, Kingston, R. I.; E. M. Stoddard, New Haven, Conn.; B. H. Walden, New Haven, Conn.; W. R. Walton,Washington, D. C.; H. I. Winchester, Melrose, Mass.; R. Wooldridge, Melrose Highlands, Mass.; L. H. Worthley, Arlington, Mass., and M. P. Zappe, New Haven, Conn.

W. E B.

Bee Disease in California. For several years bees in California have been suffering from a malady apparently coincident in time with the blossoming of the California buckeye, *Aesculus californica*. Beekeepers generally are blaming buckeye for the trouble. The condition is spoken of as "buckeye poisoning." The malady kills the field bees first, then the brood is affected. Much brood evidently dies and is pulled from the cells. The young emerging bees are badly deformed and unable to fly. Finally the bees try to supersede the old queen. The resultant young queen is worthless, seldom ever getting mated. Thousands of colonies are lost annually.

Investigational work has been started by the University of California to definitely determine the cause. It is hoped that a remedy will be found.

G. H. VANSELL